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AN ECONOMIC STUDY OF LAND USE IN THE TAIPEI AREA, TAIWAN, 1961

by

Tsoung-chao Lee
National Taiwan University
Taipei, Taiwan

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CONTENTS

Page

Chapter I INTRODUCTION

Purposes of Study 1
The Concept of Economic Land Classification 2
Definitions 3
General Description of Study Area 7
Methods and Procedures 9
Principles and Hypotheses Tested in the Study 13
References 14

Chapter II AGRICULTURAL REGIONS

Agricultural Regions 15
Comments on the Data 15
Land Area Per Person of the Farm Population 16
Land Use Pattern 16
Crop Sequence 17
Intensity of Use 18
Size of Farm Business by Regions 20
Income Data by Regions 22
Farm Equipment by Regions 25
Land Tenure by Regions 26
Some Family Characteristics 27
Level of Living by Regions 28

Chapter III ECONOMIC LAND CLASSES

Economic Land Classes 29

Size of Farms by Economic Land Classes 30

Intensity of Land Use by Land Classes 30

Gross Family Earnings by Economic Land Classes and Agricultural Regions 31

Differences in Net Income by Economic Land Classes and Agricultural Regions 33

Family Living Value by Economic Land Classes 35

Fixed Capital Per Farm by Economic Land Classes 36

Farm Equipment and Work Animals by Economic Land Classes . . 38

Crop Yields by Economic Land Classes 39

Land Tenure and Operators' Education by Land Classes 41

Chapter IV VARIATIONS AMONG FARMS IN THE SAME REGION AND LAND CLASS

Size of Farm 43

Intensity of Land Use by Size of Farm Within Land Class . . . 44

Crop Yields by Size of Farm Within Land Classes 45

Income Data by Size of Farm Within Land Class 47

General Business Summary 48

Labor Efficiency 52

Capital Efficiency 52

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Chapter V RELATIONSHIPS OF INCOME TO CAPITAL AND OF EXPENSES TO INCOME

Relation of Income to Capital 55

Relation of Farm Expense Per Chia to Income Per Chia 60

Relation of Fertilizer Expense Per Chia to Crop Income Per Chia 62

Chapter VI SUMMARY 65

APPENDICES

I. Sampling Procedure 67

II. Conversion Factors 72

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LIST OF FIGURES

Page

Chapter I

1. A Map of Hsin-chuang, Shu-lin, Ying-ko and Shan-hsia Townships, Taipei Hsien, Taiwan, China, 1962. 7

Chapter II

2. A Map of Agricultural Regions. Hsin-chuang, Shu-lin, Ying-ko and Shan-hsia Townships, Taipei Hsien, Taiwan, China, 1962. 15

Chapter III

3. A Map of Economic Land Classes. Hsin-chuang, Shu-lin, Ying-ko and Shan-hsia Townships, Taipei Hsien, Taiwan, China, 1962. 29

4. Ranges and Averages of Crop Income per *Chia* by Economic Land Classes in the Rice Region, Four Townships in the Taipei Area, Taiwan, China, 1961. . . 40

Chapter V

5. Linear Regression Lines of Total Farm Expenses per *Chia* to Gross Farm Receipts per *Chia*, in Four Economic Land Classes in the Rice Region. Four Townships in the Taipei Area, Taiwan, China, 1961. 61

6. Relation of Fertilizer Expense per *Chia* to Crop Income per *Chia*, in Four Economic Land Classes in the Rice Region, Four Townships in the Taipei Area, Taiwan, China, 1961. 62

7. Parabolic Functions Expressing the Relationship of Fertilizer Expense per *Chia* to Crop Income per *Chia*, in Four Economic Land Classes in the Rice Region, Four Townships in the Taipei Area, Taiwan, China, 1961. 62

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Chapter I

Introduction

I. Purposes of study

Taiwan, an island with an area of about 36,000 square kilometers and with a population of over 12,000,000 in 1962, has been struggling for economic progress under heavy population pressure. The annual rate of population increase in recent years is estimated to be over 3 percent. Agriculture is the main industry of this Island and is now undergoing further development at a rapid rate to meet the needs of the increasing population and to contribute to the industrial development of the island.

It is known that land varies in its adaptation to different uses and in its adapted intensity of use. Although some studies and maps of land use have been made, no economic land classification showing variations in the intensity of use to which land is adapted has been made in the Taipei area. 1/

This study was conducted as a pilot study by the graduate students of the Research Institute of Rural Socio-economics, National Taiwan University, in four townships near Taipei. The townships studied were Hsin-chuang, Shu-lin, Ying-ko and Shan-shia.

The purposes of this study were

1. To determine those factors related to intensity of land use that cause (1) broad differences in land use patterns, and (2) differences in area of land per family. These are known as "regional" factors.
2. To make a map showing agricultural regions in the study area.
3. To summarize available land use data by agricultural regions in the study area.
4. To study factors related to differences in the intensity of land use within regions. These are known as "economic land class" factors.

1/ See "An Economic Study of Land Use in Taichung Hsien and City, 1960", by Arthur W. Peterson, Visiting Professor, Research Institute of Agricultural Economics, Provincial Chung Hsing University, Taichung, Taiwan. Also, "An Economic Study of Land Use in Changhwa and Nantou Hsien, Taiwan, 1961", by Ching-Horng Lin. Research Institute of Agricultural Economics, Provincial Chung Hsing University, Taichung, Taiwan, Republic of China.

5. To make an economic land class map depicting these differences in adapted intensity of agricultural land use within agricultural regions.

6. To make a farm management survey in the study area stratified by agricultural regions and economic land class areas.

7. To develop a demonstration laboratory of people-land relationships in the Taipei Area. This demonstration area can then be used (1) For teaching college courses in Farm Management and related courses. (2) To demonstrate to people in policy-making positions important factors in land use that they should consider in making decisions about agriculture.

II. The concept of economic land classification

The term "Land", in its most widely accepted use, refers to the solid surface of the earth. For our purposes, the economic concept of land can be defined as "the sum total of the natural and man-made resources over which possession of the earth's surface gives control". 2/ The fundamental variations in land depend on variations in its relation to bodies of water, elevation, topography, climate, soil, the minerals under it, and its relation to other areas of land that are associated with it and its use.

Land is used in the study area for producing crops and livestock feed, for building sites and transportation routes.

From the economic point of view, land may be classified according to the number of people it will support, or how well it will support a given number. Agricultural regions usually vary in the amount of land per person. Therefore, land areas can be divided into regions based on differences in general land use pattern and land area per person of the farm population. Within an agricultural region, the land has similar land use patterns and livestock combinations. Sometimes these agricultural regions are called "type of farming regions". As in any other types of land classification, transition zones may occur from one type of region to another. Most of the boundaries of agricultural regions are associated with changes in climatic or marketing factors.

2/ R. Barlowe, Land Resource Economics, Prentice-Hall, 1960, pp. 7.

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Agricultural regions can be further sub-divided into economic land classes based on the intensity of use to which different land areas within each region are adapted. If differences in land use among regions are described as differences in comparative advantage for crop or livestock enterprises, or combinations of enterprises, then economic land classes may be thought of as differences in the degree of comparative advantage within the agricultural regions. Most of the boundaries of economic land classes are associated with changes in soils or topography.

I. Definitions:

1. An agricultural region is defined as a body of land which has a similar land use pattern and density of farm population which differs from neighboring regions. In the Taipei area, Rice and Upland Crops Regions were identified and mapped.

2. Economic land classes are land areas of differing economic productivity. They are smaller areas of land than agricultural regions and vary in their capacity to pay the expenses of operating a farm unit and provide an acceptable level of living for the farm family relative to the standard of the culture. In this study, five classes were identified and mapped:
   (1) Economic Land Class 1: Those farming areas where operators on typical full-time farms have received the highest level of net income per farm over a period of years belong in this class. The usual intensity of land use is the highest within the particular agricultural region.

   (2) Economic Land Class 2 : Farming areas where net farm incomes per farm unit of average size have been better, and intensity of use higher, than average for the region but measurably lower than those of Land Class I areas.

   (3) Economic Land Class 3 : Farming areas where net farm incomes per farm have been about average for typical full-time farms are grouped in this class.

   (4) Economic Land Class 4 : Farming areas where incomes per farm are usually below average, but high enough to encourage farmers hopefully to remain, fall in this class.

(5) Economic Land Class 5 : In these farming areas, net farm incomes per farm are so low that capital cannot be maintained. The intensity of use is low but too high to be justified by the capacity of the land to repay expenses.

3. Land grades reflect the different degrees of productivity of each field or plot of land. The cultivated land of Taiwan has been classified into 26 grades based on the estimated productivity of each piece of land. They have been used as a basis for taxation.

   The land grades were originally made by Japanese authorities in a survey of all land in Taiwan in the years 1898-1904. They have been adjusted several times. In 1944, the number of grades for both paddy fields and dry land was increased from 10 to 26. After Taiwan was restored to China, regional adjustments were made in 1950. The land grade was then used as a basis for determining rent reduction and land value as a part of the land reform movement. Land grades are subject to further adjustment but only after careful investigation.

4. Economic productivity of land is measured by its ability to furnish income per person.

5. Intensity of use is defined as the combined dollar value of all input factors per unit of land.

6. A farm refers to the land which has been organized into a farm business by a farm family.

7. Family is a term used to include all relatives living and eating together.

8. A household consists of all persons living and eating together, including non-relatives, such as hired laborers.

9. The owner-operator is an operator who works his own land.

10. A part-owner is an operator who works both his own land and some he rents.

11. A tenant is an operator who works rented land.

12. Man equivalent is the equivalent of an adult male, age 16 to 60, working full-time on a farm for twelve months. Time spent in farm work by women, and by males younger or older than these limits was adjusted as follows:

	Age	Man equivalent
1 adult male	16 - 60	1.0
1 woman	16 - 60	0.8
1 adult male	over 60	0.8
1 child	under 16	0.5

If a person works only six months on the farm but does no other work, he is considered as being a full-time farm worker.

13. A work unit is a 10-hour day of productive farm work.

14. Area cropped is the sum of the area in individual crops in one year. If an area was in a "permanent crop" like citrus, it was considered as cropped one time for purposes of the calculation.

15. Multiple cropping index is the percentage of area cropped relative to area cultivated.

16. Total fixed capital per farm is the sum of estimates by the operator of the present market value of land, buildings, farm equipment and machinery, work animals and livestock.

17. Farm privileges equal the value of home-produced food and fuel at farm prices. In this study, they do not include an estimate of house rent.

18. Family living value per farm household equals the estimated cash family living expenses plus the estimated value of farm privileges.

19. The calculation of several income measures and their relationship to each other are demonstrated by the data of an actual farm in the Taipei area:

(1) Cash receipts			$22,598.00	
(2) Net increase (+) or decrease (-) in inventory			1,657.00	
(3) Gross receipts from farm				$24,255.00
Farm expenses:				
Cash expenses:				
(4) Hired labor expense		$1,702.00		
(5) Fertilizer expense		3,249.00		
(6) Indirect production expenses		4,397.00		
(7) Others (seed, feed, chemicals, breeding fees, fuel, etc.)		6,011.00		
(8) Total cash expenses			$15,359.00	
(9) Depreciation			1,209.00	
(10) Estimated value of unpaid family labor (excluding operator)			6,412.00	
(11) Estimated value of unpaid operator's labor			3,445.00	
(12) Interest charge on investment (7% of total capital)			9,602.00	
(13) Total farm expenses				36,027.00
(14) Operator's management income				-$11,772.00
(15) Family living value (including taxes charged to family)			$23,761.00	
(16) Cash living expense (including taxes charged to family)			13,689.00	
(17) Estimated value of farm privileges (farm products used in the home)				10,072.00
(18) Operator's management earnings				-$ 1,700.00
(19) Off-farm income				NT$ 6,765.00
(20) Gross receipts	(3)+(19)			31,020.00
(21) Family income	(20)-(8)-(9)			14,452.00
(22) Family earnings	(21)+(17)			24,524.00
(23) Family labor earnings	(22)-(12)			14,922.00
(24) Operator's labor earnings	(14)+(11)			-8,327.00
(25) Operator's labor earnings	(18)+(11)			1,745.00
(26) Net farm income	(24)+(12)			1,275.00
(27) Net farm earnings	(26)+(17)			11,347.00
(28) Family farm income	(26)+(10)			7,687.00
(29) Family farm earnings	(28)+(17)			17,759.00
(30) Labor and capital returns per man	(28)+(4)÷(M.E.+1)*			2,990.00
(31) Labor and capital earnings per man	(29)+(4)÷(M.E.+1)*			6,198.00
(32) Labor returns per man equivalent	(4)+(10)+(24)÷M.E.*			- 100.00
(33) Labor earnings per man equivalent	(4)+(10)+(24)+(17)÷M.E.*			4,607.00
(34) Net return to farm capital	(14)+(12)			-2,170.00
(35) Rate of return on farm capital	100(34)÷Total inventory (fixed capital)**			- 1.61
(36) Net return to farm land	(34)-(Total inventory-Land value***)X0.07			-4,341.00
(37) Rate of return on farm land	100(36)÷ Land value***			- 4.17

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* M.E. is the abreviation for Man Equivalent. It equals 2.14 in this table. The (+1) in (30) and (31) is added to the man equivalent number to represent the production function of furnishing and maintaining capital.

** The total inventory of fixed capital is NT$135,186 in this table.

*** The land value is NT$104,166 in this table.

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General description of study area

1. Location

The study area, including Shin-chuang, Shu-lin, Ying-ko and Shan-shia townships, is located in the northern part of Taiwan close to Taipei City.

It is bounded by Lu-chou Hsiang, Wu-ku Hsiang and Lin-kou Hsiang to the north, Wu-lai Hsiang and Hu-hsing Hsiang to the south, Pan-chiao Township, Tu-chen Hsiang and Hsin-tien Township to the east, and Tao-yan Hsien to the west. It stretches 31 kilometers from north to south; 17 kilometers from east to west, and has an area of about 265 square kilometers.

2. Topography

The Tan-shui River, running from the southwest to the northeast, divides the area into three parts. The northwest part is an upland hill area with an elevation of less than 375 meters above sea level. The middle part of the area is a river valley. Irrigation systems coming from this river are used for paddy fields. The southeast part of the area is also an upland hill area with Hsiung-kung Shan the highest peak with an altitude of 1,350 meters above sea level.

3. The river systems

The Tan-shui River, one of Taiwan's great drainage rivers, flows from the southwest to the northeast in this area. The Shan-hsia Ho and the Heng-chi Chuan empty into the Tan-shui River from the southeast. They are too shallow for transportation purposes and are utilized principally for irrigation. (See Fig. 1)

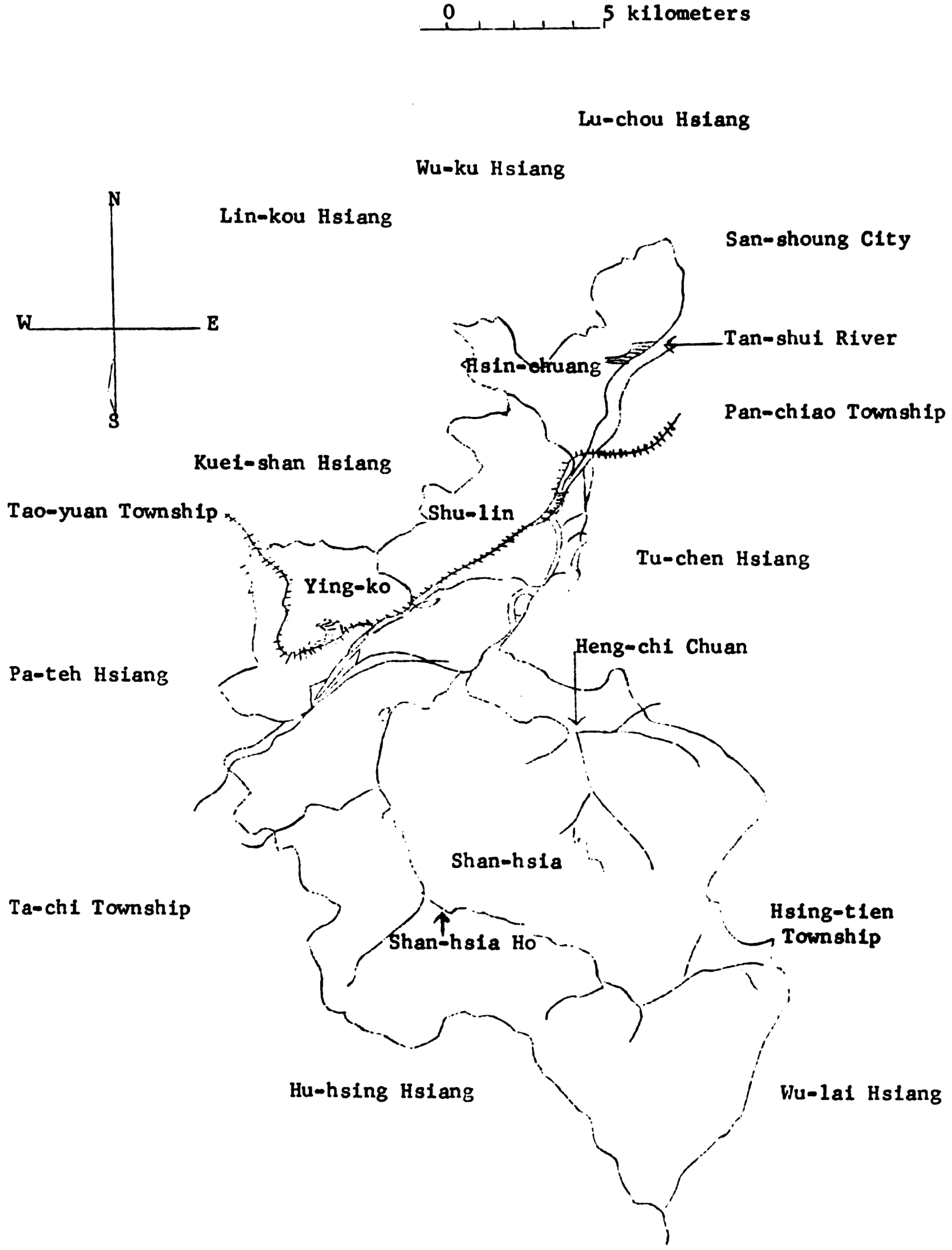
4. Soils

The underlying strata of the area were formed in the Tertiary period. The alluvial soil was accumulated by the decay of shale and sandstone. Over a long period of years the soil has accumulated humus in the upper horizons. Convenient for irrigation, the area has many paddy fields along both sides of the river. The acidity test shows that the PH of the soil ranges from 4.60 to 5.00 3/ The land grades of the paddy fields and upland non-irrigated farm areas range from 6 to 15, and from 6 to 23 respectively. 4/

3/ For more details, see Land of Taiwan, Economic Research Room of Taiwan Bank, p.p. 13-17 and p.p. 138-139.

4/ Data obtained from the land-grade maps of the Land Bureau, Taiwan.

Figure 1
A Map of Hsin-chuang, Shu-lin, Ying-ko and Shan-hsia Townships, Taipei Hsien, Taiwan, China, 1962



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5. The climate

The study area, located in the northern part of Taiwan, has a sub-tropical climate. The summer is long and accompanied by intense heat, while the winter is very short and no severe cold is experienced. Its climate is influenced by the Pacific Ocean conditions. The index of humidity ranges between 80 and 100 per cent. The average yearly rainfall varies from 1,500 mm. to 2,500 mm. Rainfall is heaviest in the summer, but the winter is also rainy, especially when compared with central and southern Taiwan. The temperature in the coldest month, February, averages less than 15°C compared with 28°C, the temperature in the warmest month, July. No snow falls in this area. As a result of these climatic traits, the area produces two crops of rice during a single year. In summer, severe typhoons, accompanied by violent winds and heavy rainfall, sometimes do heavy damage to field crops. 5/

6. Transportation

The Provincial Railway transects the area along the Tanshui River. It comes from Pan-chiao Town, passes through Shulin Town, Shan-tzu Chiao, and Ying-ko Town, then runs northward to Tao-yuan Township. In addition to the railroad, there is also a network of first and second class highways connecting almost every town and village. Every hour you can take a highway bus to any of these townships from Taipei.Roads suitable for trucks and jeeps extend to or near most communities. Within the rural areas, ox-cart roads and bicycle paths extend to almost every household.

7. Agricultural information

The four townships have a total area of 28,242 chia. Approximately one third of the area, about 9,310 chia, is cultivated (excluding forest land), of which paddy fields have an area of 4,464 chia and upland fields, 4,841 chia. There are 70 villages in this area with a total population of over 118,000, of which 43 per cent is farm population. The percentages of owners, part-owners, and tenants, are 54, 17 and 29 per cent, respectively. The farmers raise rice,

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5/ For more detail, see The Agro-climate of Formosa, Memoirs of the Faculty of Agriculture, National Taiwan University, Vol. II, No. 1, January, 1948, by C. S. Chen; and Classification and Demarcation of Climatic Regions (China, and Taiwan, China), Experimental Forestry, College of Agriculture, National Taiwan University, Bulletin No. 7, Forestry Series, March, 1957, by C. S. Chen.

vegetables, sweet potatoes, peanuts, tea, oranges, and other citrus crops (Table 1). Forestry is also an important enterprise, especially in the Upland Crops region.

Methods and procedures

In making the economic land classification, both physical and economic information, such as geographic features, the utilization of land, income, indicators of population density, land grades, and the like were used. The available data and information were placed on maps and then the various maps were superimposed over each other to study interrelationships. The information was checked against aerial photographs, land use capability maps, [6] land grade maps, and by visual inspection along the available roads.

Local opinions of crop yields, land values and changes in productivity of land were also a good source of information as a further check of economic land classes.

The data from the farm management survey were also used in checking the boundaries of agricultural regions and economic land classes. After checking doubtful areas against their land grade rating and with local farm leaders, the final map, showing main geographic features, agricultural regions,and economic land classes was drawn in different colours. The data from the farm management survey, stratified by agricultural regions and economic land classes, were analyzed. Statistical tests of significance and correlation coefficients of selected items were calculated to test the relationships between or among regions. Farm characteristics were also studied within regions and land class areas to check the application of land economic principles. The detailed procedures of this study were as follows:

1. Securing maps prepared by the Survey Department, CCSF, at scales of 1:25,000 and 1:50,000. The maps showed land use information, topography at contour intervals of 10 meters, roads, railroads, and the location of farmsteads.

2. Securing from the township offices of the study area maps showing _hsien_, township and village (or _li_) boundaries.

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[6] Land use capability mapping was sponsored by the Joint Commission on Rural Reconstruction. (JCRR) The maps were prepared by the Taiwan Research Institute with the cooperation of the Survey Bureau of the Combined Service, Taiwan Fertilizer Company and Taiwan Forestry Research Institute.

Table 1. Township Data

		Shin-chuang Township	Shu-lin Township	Ying-koo Township	Shan-shia Township	Total
Land area (Km^2) *		20.	33.	21.	191.	265
Cultivated area (Chia)	Paddy fields	1,321	1,337	627	1,179	4,464
	Upland fields	102	706	534	3,499	4,841
	Total	1,422	2,043	1,161	4,678	9,305
Farm households (number)	Owners	966	1,001	705	1,518	4,190
	Part-owners	366	370	226	469	1,431
	Tenants	193	186	163	1,169	1,711
	Total	1,525	1,557	1,094	3,156	7,332
Farm population (number)	Owners	6,138	6,018	5,262	10,080	27,498
	Part-owners	2,132	2,220	1,135	2,907	8,394
	Tenants	1,545	1,118	1,165	11,023	14,851
	Total	9,815	9,356	7,562	24,010	50,743
Number of villages		14	17	15	24	70
Total households		4,318	4,906	3,745	6,189	19,158
Total population		25,340	28,651	22,438	36,936	118,365
Main crops		Paddy rice Vegetables Sweet potatoes	Paddy rice Sweet potatoes Peanuts Tea Oranges	Paddy rice Sweet potatoes	Paddy rice Tea Oranges Sweet potatoes Peanuts Other citrus	Paddy rice Vegetables Sweet potatoes Peanuts Tea Oranges Other citrus

* Data from the Department of Civil Affairs, Taiwan Provincial Government, 1960.
Other information from Township office, September 18, 1962.

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3. Several copies of the base map showing the main topography and village boundaries were made by superimposing the two maps previously mentioned.

4. Local information concerning area of land, cultivated area, farm households, and yields of rice and other important crops were collected.

5. The area per farm household and various measures of intensity of use within regions were calculated by villages.

6. The cultivated area per household, total area per household, yields of rice, other crop yields, multiple cropping index and grade were shown on maps by first determining appropriate class intervals and then showing the different strata by different colours.

7. Capital accumulation as reflected in farm houses was rated in the field by traveling all roads where travel by jeep was possible. Many farmers were interviewed on an informal basis to get local opinions of crop yields, land values, changes in productivity of land and land grade. These data were also placed on maps.

8. The information obtained was then studied so as to better understand the inter-relationship of land use and farm population density with land features, especially topographic and climatic features.

9. Preliminary agricultural region and economic land class boundaries were drawn on 1:25,000 topographic maps where available, and on 1:50,000 maps if the larger maps were unavailable. Natural features were used as the basis for determining the exact location of the lines. Village data and field notes were used to determine the type-of-farming region and economic land class level.

10. The preliminary map was reviewed by comparing it with aerial photos and with a land use capability map at the Taiwan Forestry Aerial Photo Survey Team Laboratory.

11. Doubtful areas were checked against their land grade rating and with local farm leaders in the field.

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12. A farm management survey was conducted in the study area. 7/

13. The locations of the 250 sample farm households, both the location of the house and major fields, were placed on a preliminary map of agricultural regions and economic land classes.

14. "Sorting cards", 11" x 16" in size, were prepared for recording the original and calculated data of each household.

15. The preliminary maps of agricultural regions and economic land classes were again reviewed based upon the land use pattern, productivity, fixed capital per chia 8/ and gross farm receipts per chia.

16. Doubtful areas were given a final field check.

17. The final agricultural region and economic land class maps, at scales of 1:50,000, were completed.

18. The agricultural region and economic land class of each sample survey record was determined and recorded on the "sorting card".

19. The data on sorting cards were analyzed to discover interrelationships among land characteristics, farm characteristics and the welfare of farm people.

7/ a. A two-stage sampling method was used. Two hundred and fifty farm household samples were randomly drawn from villages which were previously selected at random, based on agricultural region and economic land class. The sample was stratified by size of farm (area) based upon information available at the township offices.

b. Twelve graduate students of the Research Institute of Rural Socio-economics, National Taiwan University and two special students from Japan and the Philippines, assisted by three undergraduate students of the Department of Agricultural Economics, National Taiwan University, served as enumerators.

c. Interviews were made from March 15 to March 25, 1962. The farm income and expense data were for the year 1961.

8/ The chia is a unit of area used in Taiwan. One chia equals 0.96992 hectares.

Principles and hypotheses tested in the study:

1. Variations in climate and distance from market usually cause differences in agricultural regions. Variations in soils or topography usually cause differences in economic land classes.

2. Some differences in land use can be mapped as agricultural regions. These regions differ in the type of farming usually practiced and in the density of population which can be supported at the usual standard of living of the country.

3. Within each agricultural region land also differs in the intensity of use to which it is adapted, and in the intensity with which it is used.

4. Land features cannot be placed in a definite formula-type of classification as long as the classification is economic.

5. Most of the income differences by areas are associated with land characteristics.

6. Farm income differences associated with differences in land characteristics are usually more apparent within agricultural regions than between agricultural regions.

7. The usual amount of capital per typical farm is a reliable, practical measure of the income producing ability of a land-type area.

8. Within each economic land class a further difference is related to size of farm business.

9. Agricultural regions do not necessarily differ in the income produced per family or per person but do vary in how many persons are supported per unit of area.

10. Factors of production share in proportion to the volume of production, and not on a basis that some factors of production having prior claims, and others residual claims.

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Chapter II

Agricultural Regions

I. Agricultural regions

The land in the study area can be divided into a Rice Region and an Upland Crops Region. The former is located along the river and the latter is located in the higher land on both sides of the Rice Region (See Fig. 2). There are about 26,547 hectares in the study area of which approximately one fourth is in the Rice Region. Over one-half of the Upland Crops Region was in Land Class 5 or in forest and was not included in the farm management study.

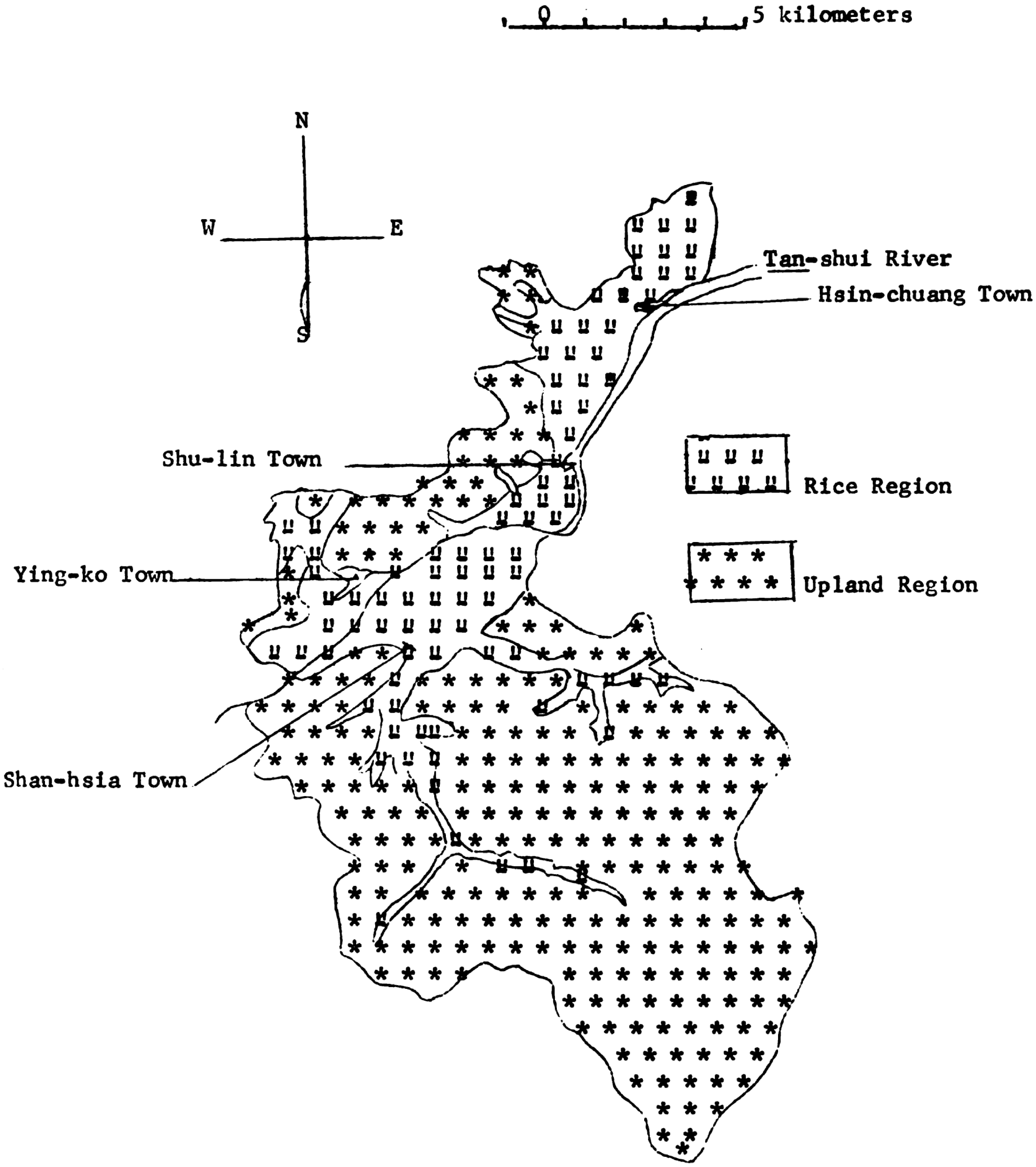
This part of the report will describe some of the characteristics of agricultural regions based on data from the 1961 farm management survey. The assumption was made that the farm house and major fields of an operator were close together, and that in most cases the land and house of a farm would be located in the same region and economic land class. A few of the Rice Region farms in the sample, however, had both upland and paddy fields. A farm with both paddy rice and upland fields was classified as falling in the Rice or Upland Crops Region based upon proportion of land in the two regions. A unit of rice land was given twice as much weighting in making this determination as a unit of upland. This problem was not serious and the author feels it does not affect the conclusions reached in the study.

II. Comments on the data

The farm interviews were taken using the sampling procedure described on page 70 (Appendix I). A stratified random sample was taken to make an effective comparison among economic land classes and for differences in size of farm. When the data were used to compare the differences between agricultural regions, they were weighted according to the estimated proportion of farms of different sizes and in different land classes within the population of farms in the study area. These weightings were determined from 1960 census data of villages.

The following table shows the estimated number of farms in each land class by size of farm within each region of the study area. These numbers provide a basis for weighting the data by land class and agricultural region:

Figure 2
A Map of Agricultural Regions.
Hsin-chuang, Shu-lin, Ying-ko and Shan-hsia Townships,
Taipei Hsien, Taiwan, China, 1962



Number of Farms *

gricultural region	Land area (chia) 0-0.54	0.55-0.94	0.95-1.34	1.35 & more	Total
ice region	1,414	1,015	867	1,139	4,435
Land class 1	245	211	158	173	787
Land class 2	759	570	475	638	2,442
Land class 3	302	183	165	211	861
Land class 4	108	51	69	117	345
		0-1.24	1.25-2.50	2.50 & more	Total
Upland region		730	363	139	1,232
Land class 3		419	164	73	656
Land class 4		311	199	66	576

* The data were counted from the farmers' list of the Agricultural Census for 1960. The data were available for the four townships in the Taipei area.

The averages presented for agricultural regions were weighted using data in this table.

III. Land area per person of the farm population

Agricultural regions vary in land area per person of the farm population. The total persons living on farms in the Rice Region averaged 8.27 persons per farm as compared with 6.65 persons in the Upland Region. The land area per person of the farm population in the Rice Region was about half that in the Upland Region, 0.13 chia compared with 0.26 chia, respectively (Table 2). The Rice Region, therefore, supports about twice as many people from the same area of land as the Upland Region (Land classes 3 and 4).

IV. Land use pattern

Because of natural forces like climate, and economic factors like distance to market, agricultural regions vary in general land use pattern. The total area per farm in the Rice Region was smaller than that in the Upland Region (Table 2). The 172 farmers interviewed in the Rice Region operated 1.11 chia compared with 1.69 chia for the 78 operators in the Upland Region. About 72 percent of the total area of the sample farms in the Rice Region was in paddy land compared with 24 percent for farms in the Upland Region. The percentages of upland fields in the two regions were about the same, 11 percent for the Rice Region and 9 percent for the Upland region. The percentage of total area in forest land for the Rice Region was 13 percent and for the Upland Region was 69 percent.

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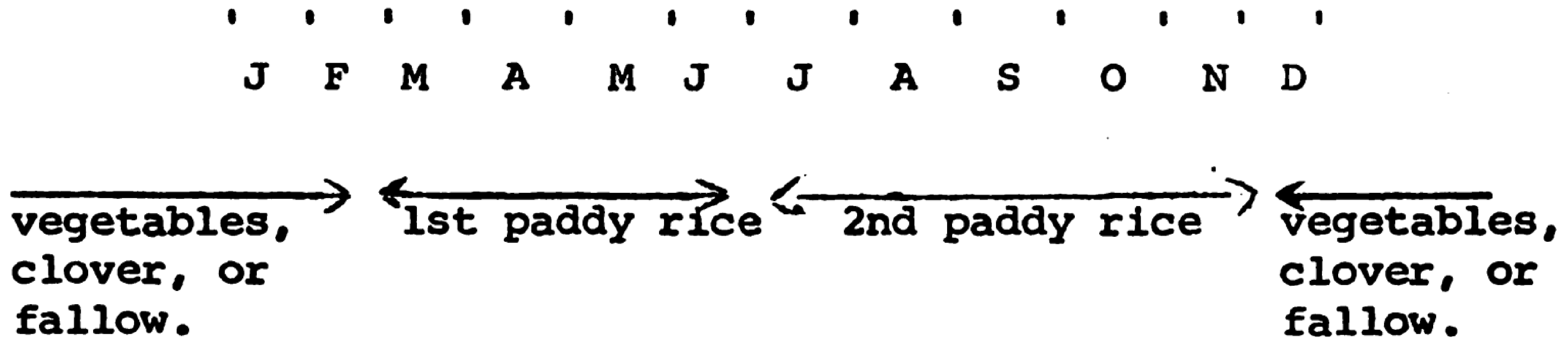
Table 2. Comparison of the Land Use of Two Agricultural Regions, Four Townships in The Taipei Area, 1961 (based on weighted data from 250 farms)

Agricultural Regions	Number of farms	Per farm: Paddy land (chia)	Per farm: Upland fields (chia)	Per farm: Tea garden & orchard (chia)	Per farm: Forest land (chia)	Per farm: Others 1/ (chia)	Per farm: Total area (chia)	Per person total area
Rice Region	172	0.80	0.12	0.02	0.14	0.03	1.11	0.13
Upland Region	78	0.21	0.15	0.15	1.16	0.02	1.69	0.26

1/ This item includes building sites, ponds, drying grounds and roads.

V. Crop sequence

The main crop in the Rice Region is paddy rice. In Taiwan, two rice crops can be grown in one year. The first crop of paddy rice, in the Taiepi area, is planted in early March and is harvested in the middle of June. The second crop of paddy rice is planted in the middle of July and is harvested in the middle of November. In the winter, farmers raise vegetables or clover or the land may be fallowed. The typical cropping system of the Taipei Rice Region is shown in the following chart:


J F M A M J J A S O N D
vegetables, clover, or fallow.
1st paddy rice
2nd paddy rice
vegetables, clover, or fallow.

There was a small area near the Tan-shui River in Hsing-chuang Township where some farmers used the irrigated fields for vegetables the year around. They took advantage of the short distance to the Taipei market, less than 10 miles away. The crops raised were makino, lettuce, cauliflower, cabbage, garlic, onions, radishes, mustard, and green pumpkins. In the Upland Region, the most common crops were sweet potatoes and peanuts, along with permanent crops such as tea, citrus, bamboo, charcoal trees, and other trees.

There are many coal mines in the Upland Region of the study area. Working the mines was one of the sources of off-farm income for the farmers who lived in this area, especially those living in the Upland.

Intensity of use

The intensity of land use represents the amount of labor, material and capital applied to a unit of land. Land was more intensively used in the Rice Region than in the Upland Region (Table 4). The total number of labor days used per unit of farm area in the Rice Region was 293 working days per chia. This compares with 179 working days per chia for the Upland Region. The total number of labor days on crops per chia of crop area was 102 working days for the Rice Region and 91 working days for the Upland Region. These measures reflect, not only the amount of work done per unit area, but also the amount of double cropping. On the average a chia of land in the Rice Region was cropped two times compared with about one and one-fourth times for farms in the Upland Region (Table 3). As the climatic factors of the Taipei area are different from those of the Taichung area, the area cropped as percent of total area of Taipei farms was not as high as in the Taichung area. In Taichung, on the average, a chia of land in the Rice Region was cropped two and one-half times. 1/

The cropping index was highest for the paddy land where the farmers raised 1st paddy rice, 2nd paddy rice and sometimes vegetables as a winter crop. In the Upland Region double cropping occurred on some fields. Farmers raised sweet potatoes in the spring and peanuts as a second crop. Tea gardens and orchards were planted as permanent crops. Sweet potatoes sometimes were grown in the forest land under the trees. The cropping indexes of different crop sequences, and for the two regions are shown in Table 3.

Table 3. Cropping Indexes, 250 Farms
Two Agricultural Regions, Four Townships in The Taipei Area, 1961

Agricultural Regions		Paddy land	Upland fields	Tea garden & orchard	Forest land	Others	Total
Rice Region	Area	0.80	0.12	0.02	0.14	0.03	1.11
	Area cropped	1.76	0.18	0.02	0.16 2/	0	2.12
	Indexes	220	150	100	114	0	191
Upland Region	Area	0.21	0.15	0.15	1.16	0.02	1.69
	Area cropped	0.42	0.20	0.15	1.36	0	2.13
	Indexes	200	133	100	117	0	126

1/ See A. W. Peterson, An Economic Study of Land Use, Taichung Hsien and City, 1960, pp. 12.

2/ Some farmers raised sweet potatoes on the forest land under the charcoal trees.

Table 4. Intensity of Land Use of 250 Farms, Two Agricultural Regions, Four Townships in the Taipei Area, 1961.

	Agricultural Regions	Rice Region	Upland Region
	Number of farms	172	78
	Total working days*	293	179
		N.T.$**	N.T.$**
	Fixed capital	$123,523	$42,126
	Hired labor expense	1,782	922
	Fertilizer expense	2,714	502
	Indirect production expenses	3,717	756
	Other cash expenses	5,255	2,143
Per chia	Total cash expenses	13,468	4,323
	Depreciation	1,034	286
	Estimated value of unpaid family labor	5,342	2,070
	Estimated value of unpaid operator's labor	3,044	2,212
	Interest charge on investment	8,711	2,949
	Total farm expenses	31,599	11,840

* A working day equals one 10-hour day of directly productive work.

** N.T.$ exchange rate with U.S. $ is $40 N.T. to $1 U.S. The "open market" trading ratio was about N.T.$45 to $1 U.S. at time of this study.

The labor used in raising livestock per farm in the two regions was about the same, 109 and 108 working days for the farms of the Rice Region and the Upland Region, respectively. Farmers near Taipei raise livestock using family labor. They do not specialize in livestock enterprises.

Hired labor, fertilizer and other cash expenses per chia were about three times as high in the Rice Region as in the Upland Region. This ratio of cash expenses ($3 N.T. in Rice Region for $1 N.T. in Upland Region) between the two regions corresponds roughly to the ratio of estimated total fixed capital between the two regions.

Estimates of non-cash expenses vary in the same direction, with estimated value of unpaid family and operator's labor showing less difference between the two regions than estimated depreciation or interest charged on investment. Total estimated farm expenses per chia were about one-fourth the estimate of fixed capital per chia in both regions.

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The total fixed capital per chia in the Rice Region was N.T.$123,523 as compared with N.T.$42,126 per chia in the Upland Region. Every item of total capital of farms in the Rice Region was higher than the same item in the Upland Region (Table 5).

Table 5. Comparison of the Fixed capital per chia on 250 farms Two Agricultural Regions, Four Townships, in the Taipei Area, 1961

Agricultural Regions	Land NT$	Buildings NT$	Equipment NT$	Working animals NT$	Livestock for breeding NT$	Total NT$
Rice Region	97,284	18,909	2,044	2,026	3,259	123,523
Upland Region	35,447	5,079	285	237	1,078	42,126

VII. Size of farm business by regions

The size of farm, measured by chia per farm, was about one and one-half times as great in the Upland Region as in the Rice Region. The total chia per farm were 1.69 and 1.11 chia respectively. Several measures of size of business, as between regions, are compared in Table 6.

The gross family earnings, which reflects the volume of business, was 42,704 N.T. dollars for the Rice Region and 27,662 N.T. dollars for the Upland Region.

On the surface this seems to indicate that the size of farm business was greater in the Rice Region than in the Upland Region. As a matter of fact, however, the farms in the Upland Region, did not have as good land for that type of farming as the land in the Rice Region, was rated for its type of farming. In economic classification, the Rice Region, in this study area, was classified as Land Class 1 to 4 while in the Upland Region no land was classified better than Land Class 3. Therefore, the differences in gross family earnings are associated with the economic land class rating, as between the two agricultural regions.

Total capital investment, which provides an estimate of how much capital a family manages, is another measure of size of business. In this study, fixed capital per farm in the Rice Region was 137,110 N.T. dollars as compared with 71,193 N.T. dollars in the Upland Region. This difference was also influenced by the distribution of economic land classes within each region of the study area. The differences in fixed capital will be described further in Chapter 3.

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Within each agricultural region the average value of fixed capital was associated with number of chia per farm (Table 7). The difference in investment from small to large farms was greater in the Upland than in the Rice Region, based upon the size groupings used by Peterson and his students in the Taichung study. 1/

The difference in working days per farm of the two regions was not great, 325 days per farm for the Rice Region and 302 days per farm for the Upland Region.

Man-equivalent, which is not affected by either price or yield, is a measure of farm size based on the labor input. But its usefulness is limited to comparing farm sizes of the same degree of labor efficiency and mechanization. In this study, man equivalent per farm for the Rice Region was 2.11 and for the Upland Region was 1.51.

Based on the data from the sample of farms in this study, it is reasonable to conclude that the total area of land operated per farm is larger in the Upland Region than in the Rice Region. In volume of business, however, the farms in the Rice Region of this study area have larger size of business than farms in the Upland Region.

Table 6. A Comparison of Size of Business, 250 Farms Two Agricultural Regions, Four Townships in the Taipei Area, 1961

Agricultural Regions	Number of farms	Area per farm (chia)	Fixed capital per farm (NT$)	Gross family earnings (NT$)	Cash expenses per farm* (NT$)	Work units per farm (days)	Man equivalents per farm (number)
Rice Region	172	1.11	137,110	42,704	14,949	325	2.11
Upland Region	78	1.69	71,193	27,662	7,306	302	1.51

* Cash expenses included hired labor expense, fertilizer expense and indirect production expenses.

1/ A. W. Peterson, op. cit.

Table 7. Average Value of Fixed Capital Per Farm by Agricultural Regions and Size of Farm, 250 Farms, Four Townships in the Taipei Area, 1961.

Agricultural regions	Size of farm				
	very large	large	medium	small	average
	1.35 chia and larger	0.95 to 1.34 chia	0.55 to 0.94 chia	0.54 and smaller	all
Rice Region	NT$ 236,952	NT$ 158,006	NT$ 68,089	NT$ 60,945	NT$ 137,110
		Size of farm			
		2.5 chia and larger	1.25 to 2.40 chia	1.24 and smaller	all
Upland Region		NT$ 295,679	NT$ 78,891	NT$ 25,488	NT$ 71,193

VIII. Income data by regions

Farmers receive their remuneration from farming in two different forms: cash farm receipts and home consumed production of the farm (called farm privileges). Cash farm receipts averaged N.T.$22,034 for the Rice Region and N.T.$10,821 for the Upland Region. Farm Privileges were N.T.$9,693 for the Rice Region and N.T.$3,352 for the Upland Region (Table 8).

Table 8. Comparison of Farm Cash Receipts with Farm Privileges, 250 Farms, Two Agricultural Regions, Four Townships in the Taipei Area, 1961

Agricultural region		(1) Cash receipts from farm	(3) Farm privileges	(1) + (2) Total
Rice Region	Amount	NT$22,034	NT$9,693	NT$31,727
	Percent	69	31	100
Upland Region	Amount	NT$10,821	NT$3,352	NT$14,173
	Percent	76	24	100

Usually cash income signifies the extent of economic progress in the specialization and division of labor. From the data shown in Table 8, farmers in the Rice Region showed more progress in farming than farmers in the Upland Region. In addition, the value of farm products used in the home was higher in the Rice Region than in the Upland Region. This is because rice is a staple food in Taiwan and the farmers in the Rice Region were more self-sufficient in rice supply than farmers in the Upland Region. Some families in the Upland Region have to buy rice if it is to be a staple food in their diet.

In comparing the cash receipts with farm privileges, the farmers interviewed in the Rice Region, however, reported that 69 per cent of their total production was for exchange. This compares with 76 per cent in the Upland Region. Apparently, families in the Upland Region sold a higher proportion of their production than the families in the Rice Region.

Gross farm receipts, cash receipts adjusted for inventory changes, were higher for the farmers in the Rice Region than in the Upland Region (Table 9).

When farm expenses are deducted from gross farm receipts the Family Farm Income of sample farms in the two regions looked similar, being a little higher in the Upland Region (around 7,800 N.T. dollars) than in the Rice Region (around 7,600 N.T. dollars) (Table 9). If farm privileges are added to Family Farm Income, the resulting Family Farm Earnings averaged about 17,000 N.T. dollars in the Rice Region and compared with 11,000 N.T. dollars in the Upland Region.

Table 9. A Comparison of Income Per Farm, 250 Farms, Two Agricultural Regions, Four Townships in the Taipei Area, 1961

Agricultural region	Number of farms	Gross farm receipts	Value of farm privileges	Off-farm income	Gross family earnings	Family farm income	Labor and capital earnings per man
		N.T.$	N.T.$	N.T.$	N.T.$	N.T.$	N.T.$
Rice Region	172	23,671	9,963	9,340	42,704	7,574	6,188
Upland Region	78	15,589	3,352	8,726	27,662	7,800	5,064

Off-farm income of the Rice Region was a little higher than that of the Upland Region. The Rice Region provides a better possibility of a labor supply for industrial development because of its location. Hsin-chuang Township, a suburb of Taipei City, is a newly developed industrial area for many kinds of industries, such as textile, electrical, and pharmaceutical plants. Building new houses to meet the population expansion and working at the factories provide sources of off-farm income for farmers, especially for those who live in the Rice Region which in addition to being closer to the plants, has better transportation facilities.

Shu-lin Township has two main factories, a wine factory belonging to the Taiwan Provincial Wine and Cigarette Monopoly Bureau, and China Fermentation Factory belonging to a private corporation. Ying-ko Township is noted for its pottery hand-craft industry. The people make pots, dishes, vases and insulators for electrical use. Shan-shia Township is located in the Upland Hill Region. Here the coal mining industry is the main source of off-farm income for the farmers. Thus, the opportunities for farmers to work outside the farms, in this study area, are good in both regions.

Gross Family Earnings (calculated by adding gross farm receipts, value of farm privileges and off-farm income together) was twice as high in the Rice Region as in the Upland Region. When we compare the average family earnings of Economic Land Class 3 and 4 of the Rice Region with farms from the same land classes in the Upland Region, the differences in incomes between the two regions are much less, as shown in Table 9B. The main difference is in the amount of farm privileges.

Table 9B. A Comparison of Income Per Farm, 132 Farms Two Agricultural Regions, Four Townships in the Taipei Area, 1961

Agricultural region	Number of farms	1 Gross farm receipts	2 Value of farm privileges	3 Off-farm income	(1+2+3) Gross family earnings	Family farm income	Labor and capital earnings per man
		N.T.$	N.T.$	N.T.$	N.T.$	N.T.$	N.T.$
Rice Region Land Classes 3 and 4,	54	16,619	8,038	8,647	33,304	4,701	5,146
Upland Region Land Classes 3 and 4,	78	15,589	3,352	8,726	27,662	7,800	4,334

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Labor and Capital Earnings per man was calculated by adding Family Farm Earnings to wages paid to hired labor and dividing the resulting total by man equivalent plus one. This calculation assumes that there is the equivalent of one man to provide and maintain capital per farm in addition to the regular labor force. The amount, N.T.$6,188 is higher in the Rice Region than the N.T.$5,064 per man in the Upland Region (Table 9B).

The two agricultural regions differ in the importance of various sources of income. In this study, the farm receipts of the two regions played the same important roles in the Gross Family Earnings. The farm privileges of the farmers in the Upland Region, however, were not as high as those of the farmers in the Rice Region. But the off-farm income was an important source of Family Earnings in both regions.

The farmers in the Upland Region could not depend on farm income alone to provide a good life but sought off-farm income. Off-farm income is important for farmers in the Taipei Area. It represented 20 percent of Gross Family Earnings in the Rice Region and more than 30 percent in the Upland Region (Table 10). This compares with 6 to 14 percent as calculated for the same regions in the Taichung area. 1/

Table 10. Percent Farm Privileges, Off-farm Income and Farm Receipts were of Gross Family Earnings, 250 Farms, Located by Regions, Four Townships in the Taipei Area, 1961

Agricultural region	Gross family earnings	Farm privileges	Off-farm income	Farm receipts	Total
	(total N.T.$)	(Percent)	(Percent)	(Percent)	(Percent)
Rice region	42,704	23	22	55	100
Upland region	27,662	12	32	56	100

IX. Farm equipment by regions

Every farm in the Rice Region had at least one hoe and one plow; every two farms had a buffalo, a thresher, a hand harrow, an animal-drawn harrow, and a cycle trailer; every three farms had a sprayer and a grain winnowing machine. On the average every 25 farms had a power tiller, based on the 172-farm sample from the Rice Region (Table 11).

1/ See A. W. Peterson, op. cit., page 17.

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In the Upland Region, the hoe was so common that every farm had at least three of them. The hand harrow, animal drawn harrow, and plows were also common, especially for those farmers who owned paddy land.

The power tillers, in this study area, were used in transporting vegetables to the Taipei Central Market more than in field work. Some farmers harvest vegetables in the afternoon and pack them on the cycle trailers at night. Then early in the morning, before sun-rise, they haul the trailer to the market by means of a power tiller. The 250 farm operators in this study reported owning only 4.5 ox-carts (Table 11).

Table 11. Kinds of Equipment and Number of Work Animals Reported by Agricultural Regions, 250 Farms, Four Townships in the Taipei Area, 1961 *.

Agricultural Regions	Rice Region		Upland Region	
Number of farms	172		78	
	Total	Per 100 farms	Total	Per 100 farms
Work animals	90	52	14	18
Ox-carts	4.5	3	0	0
Power tillers	7	4	1	1
Cycle trailers	91	53	5	6
Plows	178	104	43	55
Threshers	122	71	16.5	21
Winnowing machines	61	35	15.5	20
Sprayers	70	41	7	09
Hand harrows	101	59	38	49
Animal-drawn harrows	87	51	30	38
Hoes	305	177	243	312

* The fractions are caused by farmers owning a share in equipment or animals.

X. Land tenure by regions.

About 62 percent of the farm families in the Rice Region reported that they were full-owners. Only 11 percent of the farm families in this region were tenants. There was not much difference in tenure characteristics between the Rice and the Upland Regions, but the part-owners were more important in the Rice Region than in the Upland Region. Full-owners, on the other hand, were relatively more numberous in the Upland than in the Rice Region (Table 12).

The percent of owners in this area was higher than the average for the whole Province. The percent of tenants was lower. According to a Provincial Department of Agriculture and Forestry, publication, Taiwan 1961 Agricultural Yearbook, the percent of owners, part-owners and tenants in the whole island, including

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Penghu Prefecture was 64 percent, 21 percent and 15 percent, respectively. The comparable figures for the Taipei Prefecture were 59 percent, 24 percent and 17 percent.

Table 12. Tenure Status As Reported by 250 Farm Operators, Two Agricultural Regions, Four Townships in the Taipei Area, 1961

Agricultural region	Owners		Part-owners		Tenants		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Rice Region	106	62	47	27	19	11	172	100
Upland Region	61	78	8	10	9	12	78	100

XI. Some family characteristics

The data show that 30 percent of the operators in the Rice Region never attended school compared with 50 percent for the Upland Region (Table 13). The farmers in the Rice Region probably came from higher-income families and they lived in a region with a more dense population.

Table 13. Operator's Education, 250 Farms Two Agricultural Regions, Four Townships in the Taipei Area, 1961.

Agricultural region	Total		No school		Primary school		Junior middle school	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Rice Region	172	100	52	30	144	66	6	4
Upland Region	78	100	39	50	34	44	5	6

The age of the farm operators was not greatly different between the two agricultural regions, although those in the Rice Region averaged 2 years younger than those in the Upland Region. In both regions about 52 percent of the population were in the years of 15-60, 42 percent were under 14 years and only 6 percent were more than 60 years old (Table 14). There may be some significance to the smaller numbers in the young and middle aged brackets in the Upland Compared with the Rice Region. Either the birth rate is lower or the out-migration is higher in the Upland than in the Rice Region.

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Table 14. Age Distribution of Family Members, 250 Farms in Two Agricultural Regions, Four Townships, the Taipei Area, 1961.

Agricultural regions	Persons living on the average farm	0-14 years old		15-60 years old		60 years and more		Age of operators
		Male	Female	Male	Female	Male	Female	
Rice Region	8.27	1.92	1.56	2.18	2.17	0.25	0.19	46
Upland Region	6.65	1.46	1.34	1.62	1.84	0.22	0.17	48

XII. Level of living by regions

The level of living as measured by "living value" per person, was about 6 percent higher in the Rice than in the Upland Region. The difference may not be sugnificant. But in the Rice Region, a farm averaged 1.11 chia and supported 8.27 persons as compared with a farm of 1.69 chia in the Upland Region which only supported 6;65 persons.

The main difference between the two regions was in the farm privileges. The Rice Region provided more home-consumed products than the Upland Region (Table 15).

Table 15. Level of living, 250 Farms, Two Agricultural Regions, Four Townships in the Taipei Area, 1961

Agricultural region	Persons living on the farm	Total food value per person	Total non-food expense per person	Total family living value per person	Per farm		
					Estimated value of farm privileges	Cash living expense	Family living value
		NT$	NT$	NT$	NT$	NT$	NT$
Rice Region	8.27	1,804	1,184	2,988	9,693	15,221	24,914
Upland Region	6.65	1.746	1,072	2,818	3,352	14,846	18,198

Chapter III

Economic Land Classes 1/

I. Economic land classes

Five economic land classes, or land areas of differing economic productivity, were distinguished in this study area, as shown in Fig. 3. Small areas of Economic Land Class I, about 4 percent of the total area, were found in Hsing-chuang Township and Shu-lin Township, as the map indicates Fragments of Economic Land Class 3, about 11 percent of the total area, were scattered in the river valley and a few on the hills. The percentages of Economic Land Classes 2, 4, and 5 in the total area were 13, 28 and 44 percent, respectively (Table 16).

The land grades, another measure of the productivity of land, vary in the same direction as the economic land classes. Generall speaking, the land grades of the Economic Land Classes 1, 2, 3 and 4 in the Rice Region are 6,8,9 and 10 respectively. The land grades of the Economic Land Classes 3 and 4 in the Upland Region are 16 and 18 respectively. In this study, no sample farms were studied in Economic Land Class 5.

Table 16. Economic Land Classes,
Four Townships in the Taipei Area, 1961

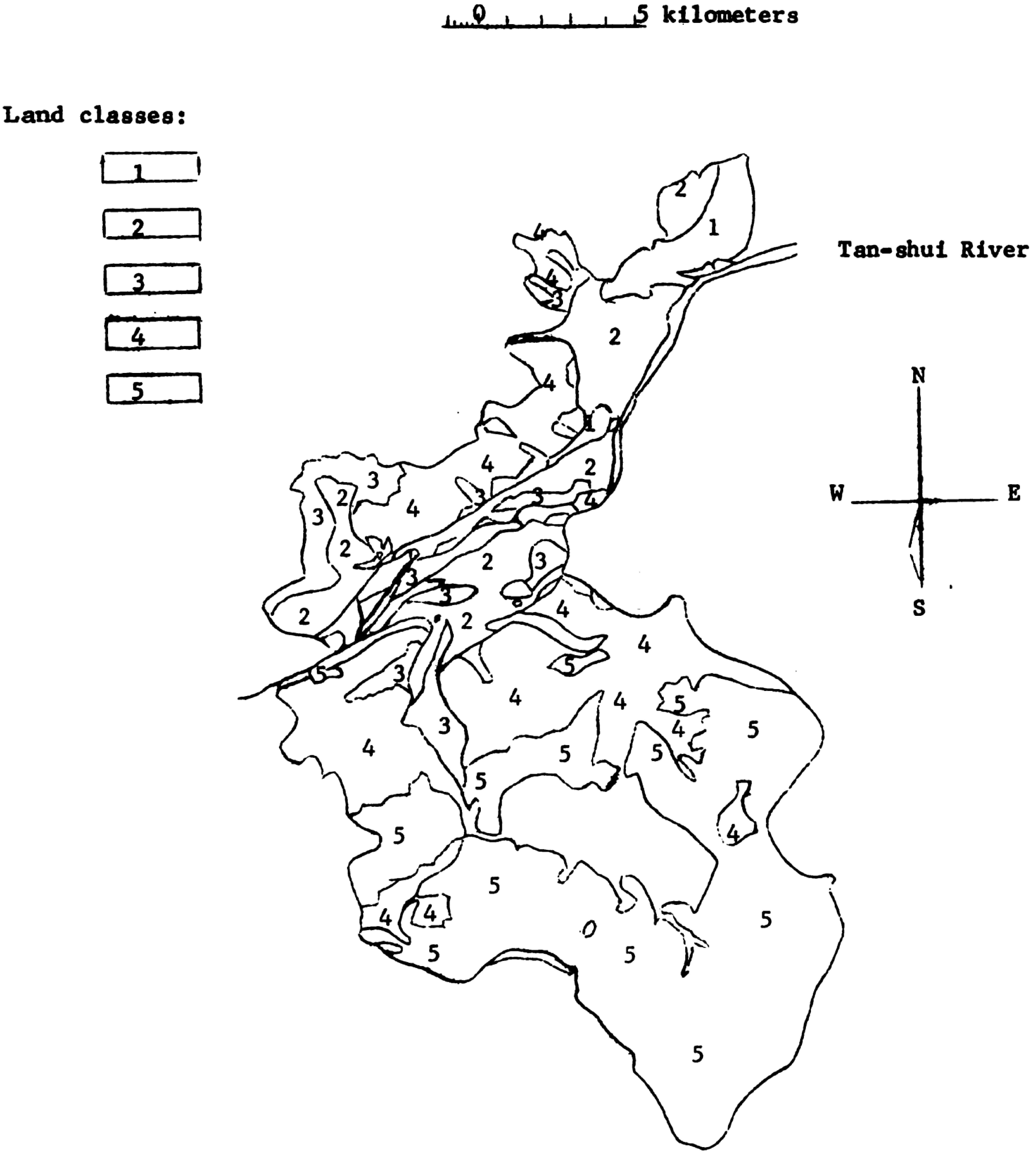
Agricultural regions & economic land classes	Estimated percentage in the total area	Estimated area (chia) a/	Average land grade b/
Rice region	28	7,708	8
Economic Land Class 1	4	1,129	6
Economic Land Class 2	13	3,566	8
Economic Land Class 3	6	1,750	9
Economic Land Class 4	5	1,263	10
Upland region	72	19,585	18
Economic Land Class 3	5	1,326	16
Economic Land Class 4	23	6,326	18
Economic Land Class 5	44	11,933	--
Total	100	27,293	--

a/ Estimated area includes cultivated land and non-cultivated land.

b/ Each field has been given a number, by Taiwan government tax authorities, based upon estimated productivity. The numbers vary from 1 to 26; productivity decrease as the number gets larger.

1/ The averages presented by Economic Land Classes were also weighted using data in th table on page 16. (Chapter II, Section II).

Figure 3
A Map of Economic Land Classes.
Hsin-chuang, Shu-lin, Ying-ko and Shan-hsia Townships,
Taipei Hsien, Taiwan, China, 1962



Note: Because the use of color or some more complicated means would be required to show this with good effect, the classification of small areas has not been indicated.

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II. Size of farms by economic land classes

Within agricultural regions, the differences in farm size among economic land classes were not as great as the difference between agricultural regions. The average areas per farm for four land classes in the Rice Region and two land classes in the Upland Region are shown in Table 17.

When Student's t-test was applied to test the significance of differences between averages, the results of the test showed no relationship between size of farm and economic land class. The differences were not significant even at the 5 percent level.

III. Intensity of land use by land classes

Land was more intensively cropped in Economic Land Class 1 than in Economic Land Class 2, and so on. The figures in table 17 show the cropping index for Land Class 1 as 206. Similar figures for Economic Land Classes 2, 3 & 4 in the Rice Region and Economic Land Classes 3 & 4 in the Upland Region were 202, 172, 142, 129 and 123, respectively. The difference between Economic Land Class 3 in the Rice Region and in the Upland Region is caused by the difference in land use patterns of the two regions. (See Chapter 2.)

The farms studied in Land Class 1 of the Rice Region were more intensively cropped than those in Land Classes 2, 3, and 4, mostly because of a higher percentage of area used for winter crops. Table 18 reveals that the average percentages of paddy land used for winter crops in Land Classes 1, 2, 3, and 4 in the Rice Region were 16%, 14%, 10% and 11%, respectively. But on the average, the percent of paddy land used for winter crops in the Taipei area was lower than in the Taichung area where the average was 70 percent on the best land. 1/

Table 19 shows the intensity of land use by economic land classes. The highest amount of the total work days, fixed capital hired labor, fertilizer and other cash expenses applied to a unit of farm land appeared in Land Class 1 of the Rice Region. Economic Land Class 4 was the least intensively used of all land classes in the Rice Region. Highest gross farm earnings per chia were also found in Land Class 1. They averaged N.T.$43,643 in this land class. Economic Land Class 4 of both the Rice Region and the Upland Region yielded low gross farm earnings. Areas of good land, for a particular region, will ordinarily be used more intensively than areas of lower productive potential. It should

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1/ See Arthur W. Peterson, An Economic Study of Land Use in Taichung Hsien and City, 1960.

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be noted, however, that other factors, such as availability of capital and labor, and the attitudes and goals of those who own and operate the land, also will affect the intensity of land use within land areas of similar quality.

Table 17. Cropping Indexes, 250 Farms,
Economic Land Classes, Four Townships in the Taipei Area, 1961.

Economic land class	Rice				Upland	
	1	2	3	4	3	4
Area	1.17	1.03	1.16	1.42	1.70	1.68
Area cropped	2.41	2.08	2.00	2.02	2.19	2.07
Indexes	206	202	172	142	129	123

Table 18. Percent of Paddy Land Used for Winter Crops in
The Rice Region by Economic Land Classes, Four Townships in the Taipei
Area, 1961.

Economic Land Class	Per Farm			
	1	2	3	4
Area of Paddy Land (chia)	1.00	0.79	0.77	0.41
Area used for Winter Crops (chia)	0.16	0.11	0.07	0.05
Percent of Paddy Land Used for Winter Crops	16%	14%	10%	11%

Table 19. Intensity of Land Use in Economic Land Classes,
Four Townships in the Taipei Area, 1961

Economic land class	No. of farms	Per Chia					
		Work days	Fixed capital	Gross farm earnings	Hired labor expense	Fertilizer expense	Other cash expenses
			N.T	N.T.	N.T.	N.T.	N.T.
Rice 1	33	327	180,424	37,301	2,428	3,517	10,749
Rice 2	85	318	131,249	33,328	1,653	3,154	10,105
Rice 3	38	232	85,321	23,800	2,009	1,901	7,367
Rice 4	16	215	52,424	11.910	773	573	3,062
Upland 3	19	185	45,535	13,154	1,209	628	3,027
Upland 4	59	172	38,204	8,980	594	359	2,750

IV. Gross family earnings by economic land classes and agricultural regions.

Farm families received income from two sources: from their farms and from off-farm work. The former included the value of farm products sold, the change in the value of inventory available for sale, and the value of farm privileges. Table 20 shows the components of gross family earnings of the 250 farms.

Table 20. Farm Receipts, Farm Privileges and Off-farm Income
Compared as a Percent of Gross Family Earnings, by Economic Land Classes,
Four Townships in the Taipei Area, 1961

Economic land class	No. of farms	Farm Receipts		Farm Privileges		Off-farm income		Gross family earnings	
		NT$	%	NT$	%	NT$	%	NT$	%
Rice 1	33	32,572	53	11,071	18	18,282	29	61,925	100
Rice 2	85	24,255	59	10,072	25	6,765	16	41,092	100
Rice 3	38	18,578	50	9,029	25	9,285	25	36,892	100
Rice 4	16	11,730	48	5,565	23	7,055	29	24,350	100
Upland 3	19	18,644	62	3.717	12	7,858	26	30,219	100
Upland 4	59	12,146	49	2,940	12	9,703	39	24,789	100

Economic Land Class 1 families had higher farm receipts than families from any other land class. The difference in amounts between land classes in sequence was about 7,000 N.T. dollars, with the highest amount, N.T.$32,572, in Land Class 1 of the Rice Region. But farm receipts in the two regions were about the same in the same class. The percentage farm receipts were of gross family earnings was about the same in all classes, roughly fifty percent in this study.

Farm privileges were a higher total amount in Economic Land Class 1 than in the other land classes but a smaller percent of gross family earnings. Farm privileges decreased slowly from Land Class 1 to Land Class 3, but from Land Class 3 to Land Class 4 the drop was about $3500 N.T., in the Rice Region. Farm families in the Upland Region produced smaller amounts of farm privileges - only about 60 percent as much as in Land Class 4 of the Rice Region (See Chapter 2). The percent that farm privileges were of Gross Family Earnings ranged from 12 to 25 percent.

Off-farm incomes averaged about the same amount in all classes except Land Class 1, where the off-farm income of 18,282 N.T. dollars was about twice as high as in other land classes of both regions. Land Class 1 is located close to town, and family members have a good opportunity to work off the farm. Off-farm incomes, however, were a higher percentage of gross family earnings as the land class changed from 2 to 4; the range in average being 16 percent to 29 percent. This suggests that the off-farm income becomes more important as the land gets poorer.

Gross Family Earnings, which is the total of farm receipts, farm privileges and off-farm income were higher in Economic Land Class 1 than in other land classes. The lowest average Family Earnings was N.T.$24,350 in Land Class 4, compared with N.T.$61,925 in Land Class 1. There was much less difference in Family Earnings between agricultural regions if farms in the land classes III and IV are compared with the same classes of the upland region. It seems reasonable to conclude that farm income differences are more likely to be associated with differences in land characteristics within an agricultural region than between agricultural regions.

V. Differences in net income by economic land classes and agricultural regions.

Just as the gross family earnings, described in the last section, varied by economic land class, in a similar manner most other measures of net income did also. The highest amount of net income was found on the farms of Land Class 1, no matter which measure was used. Land Class 4 in both regions tended to have the lowest net income per farm, per family and per man (Table 21).

Table 21. A Comparison of Different Ways to Measure Income, by Economic Land Classes, 250 Farms, Four Townships in the Taipei Area, 1961.

Economic land class		Family farm income	Family income	Family farm earnings	Family earnings	Labor and capital returns per man	Labor and capital earnings per man
		N.T.$	N.T.$	N.T.$	N.T.$	N.T.$	N.T.$
Rice	1	11,532	29,814	22,603	40,885	4,215	7,462
Rice	2	7,687	14,452	17,659	24,524	2,990	6,198
Rice	3	4,625	13,910	13,654	22,939	2,576	5,920
Rice	4	4,892	11,497	10,457	17,512	1,843	3,555
Upland	3	9,895	17,753	13,612	21,470	4,668	6,120
Upland	4	5,440	15,143	8,380	18,083	2,628	3,828

If "farm privileges" are omitted, as they are in Family Farm Income and Family Income, then the Upland Region appears to have a higher income than the Rice Region. When "privileges" are included, however, the same land classes in the two regions appear remarkably similar, as shown in Table 21.

When Student's t-test is applied to test the significance of the difference in various income measures between land classes 1 and 2, 2 and 3, and 3 and 4, with the hypotheses of u_1 u_2 u_3 u_4, where u_1, u_2, u_3, and u_4 represent population means of each land class, the differences are very significant with the probability of 99%, except the difference in family farm income between land classes 3 and 4. The differences in family farm earnings among land classes are more significant than any other of the income measures studied.

When the analysis of variance is used differences in family farm earnings among economic land classes and by area (size) per farm within land class can be proved. Table 22 shows Family Farm Earnings in the Rice Region by land classes and size of farm:

Table 22. Family Farm Earnings in the Rice Region by Economic Land Classes and Size of Farm, Four Townships in the Taipei Area, 1961

Economic land classes	1	2	3	4
Size of farm 1/	N.T.$	N.T.$	N.T.$	N.T.$
Very large	45,653	34,856	24,115	13,501
Large	23,643	17,008	17,558	14,063
Medium	17,733	15,737	10,950	5,034
Small	9,815	5,405	5,685	7,418

1/ Size classes are as follows:

Very large	1.35 and over
Large	0.95 to 1.34
Medium	0.55 to 0.94
Small	0.54 and under,

Table 23 shows the data used in calculating the analysis of variance.

Table 23. An Analysis of Variance for Family Farm Earnings by Economic Land Class and Size of Farm

Source of variance	Sum of squares	Degrees of freedom	Mean square	Ratio of mean square	99% & 95% table value F
Among classes	432,603,981	3	144,150,995	4.34	F_9^3 (0.05) = 3.863
Within classes	1,111,331,122	3	370,443,707	11.16	
Residual	298,746,535	9	33,194,059		
Total	1,842,681,638	15			F_9^3 (0.01) = 6.992

In the final analysis, the ratio of mean square 4.34 is greater than the F-value of the F-distribution 3.863 at the 5 percent significance level; and the ratio 11.16 is greater than 6.992, F-value of F-distribution at the 1 percent significance level. The interpretation of these figures reveals that Family Farm Earnings differ significantly among land classes at the 95% probability level, and by size of farms within land classes at the 99% probability level.

VI. Family living value by economic land classes.

In the Rice Region, family living value, including value of farm-produced and purchased products, averaged about N.T.$30,000 for Land Class 1, and N.T.$24,000 for Land Classes 2 and 3, and N.T.$20,000 for Land Class 4. The family living value was lower in the Upland Region, about 18,000 N.T. dollars.

On a per person basis, Land Classes 1, 2 and 3 of the Rice Region had a family living value of about N.T.$3,000 per year. A comparable figure for Land Class 4 Rice or Land Classes 3 and 4 of the Upland Region was about N.T.$2,500 per year. There was some tendency for the level of living to be highest in Land Class 1, decreasing as the land was rated as less productive.

More than one-half of the total living value was purchased in the market. The percent purchased increased from Land Class 2 to 4. Land Class 1 was a special case, its percent purchased being a little higher than Land Classes 2 and 3, although its farm privileges were also higher than those of other land classes. Farm families in Land Class 1 spent more cash than any others on living expenses, probably because they received the highest income.

Because of the differences in land use patterns between the two agricultural regions (Rice and Upland) as mentioned in chapter 2, Land Classes 3 and 4 of the Upland Region produced a small amount of farm privileges and spent more cash to buy the staple food - rice from the Rice Region or from the market. Therefore, the percent purchased was highest in Land Class 4 of the Upland Region where the percent purchased was over 80 percent. Land Class 4, Rice Region, was also relatively high, about 70 percent.

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Table 24. Estimated Total Family Living Value and Amount of This Total Produced on the Farm and the Amount Purchased, by Economic Land Classes, Four Townships, in the Taipei Area, 1961

Economic land class	Number of persons living on the farm	Family living value			
		Total NT$	Farm produced NT$	Purchased NT$	Percent purchased
Rice 1	9.09	31,507	11,071	20,436	65
Rice 2	7.88	23,761	10,072	13,689	58
Rice 3	8.45	24,138	9,029	15,109	63
Rice 4	8.44	19,849	5,565	14,284	72
Upland 3	6.19	18,032	3,717	14,315	79
Upland 4	7.17	18,386	2,940	15,446	84

VII. Fixed capital per farm by economic land classes

The total fixed capital per farm was higher on the good land than on the poor land. In the Rice Region it varied from $211,097 N.T. per farm in Land Class I to $74,442 N.T. in Land Class IV. The value of land and other forms of capital varied in the same direction as total capital per farm. Based on this survey, one *chia* of the land in Economic Land Class 1 was worth 145,000 N.T. dollars on the average. Estimated value of the land per *chia* in the Rice Region was N.T.$100,000, 70,000 and 40,000 in Land Classes 2, 3 and 4 respectively. Land Classes 3 and 4 in the Upland Region were valued at only N.T.$38,000 and 32,000 per *chia*.

Higher returns per family were found on the good lands associated with higher capital accumulation. For example farm buildings on Economic Land Class 1 averaged about N.T.$30,000 per farm compared with less than N.T.$10,000 per farm for Land Classes 3 and 4 of the Upland Region. Poor cabins, small roughly-built houses covered with dried leaves or straw, no glass windows, and only dirt for a floor, were found on the poor hill-land farms. These were in contrast to the sturdy, brick buildings of the large farms in Land Classes 1 and 2.

Farming is more mechanized in Land Class 1 than in other land classes. The value of equipment averaged N.T.$3,846 in Land Class 1 compared with N.T.$679 for Land Class 4 of the Rice Region and N.T.$445 for Land Class 4 of the Upland Region.

In short, every item of fixed capital per farm decreased in amount as the productivity of the land decreased.

The most important part of the total fixed capital was land; it usually accounted for more than 80 percent of the total fixed capital. Eleven to 16 percent of the total investment was represented by buildings, 1 or 2 percent by equipment and work animals and about 2 to 3 percent by "productive" livestock. The distribution of the investment among items is shown in Tables 25 and 26.

Table 25. Distribution of Various Items of Fixed Capital Per Farm, by Economic Land Classes, Four Townships in the Taipei Area, 1961

Economic land class	Total	Land	Buildings	Equipment	Work animals	Productive livestock
	N.T.$	N.T.$	N.T.$	N.T.$	N.T.$	N.T.$
Rice 1	211,097	170,200	30,231	3,846	2,132	4,688
Rice 2	135,186	104,166	22,676	2,204	2,573	3,567
Rice 3	98,972	80,535	11,446	1,633	1,996	3,362
Rice 4	74,442	59,452	11,257	679	891	2,163
Upland 3	77,410	65,241	9,057	515	526	2,071
Upland 4	64,183	53,241	8,048	445	260	1,542

Table 26. Various Items of Fixed Capital as a Percent of Total Fixed Capital, by Economic Land Classes, Four Townships in the Taipei Area, 1961

Economic land class	Total	Land	Buildings	Equipment	Work animals	Productive livestock
Rice 1	100	80.63	14.32	1.82	1.01	2.22
Rice 2	100	77.05	16.77	1.63	1.91	2.64
Rice 3	100	81.37	11.56	1.65	2.02	3.40
Rice 4	100	79.86	15.12	0.91	1.20	2.91
Upland 3	100	84.28	11.70	0.67	0.68	2.67
Upland 4	100	83.96	12.54	0.69	0.41	2.40

VIII. Farm equipment and work animals by economic land classes

Farms in Land Class 1 possessed a larger number of farm equipment pieces than in other land classes. Plows, threshers, sprayers, hand harrows, animal-drawn harrows, cycle trailers and power tillers were more likely to be found in Land Class 1 than in other land classes of the Rice Region. Power tillers were only found in Land Classes 1, 2, and 3 in the Rice Region, based on our survey. Work animals were relatively more numerous in Land Class 3 of the Rice Region than in other areas. On the average, a farm in Land Class 3 of the Upland Region had at least 4 hoes. These are the most common and important tool in the upland.

On the average, 100 farms in Land Class 1 had 5 power tillers, 40 work animals, 56 winnowing machines, 65 sprayers, 65 cycle trailers, 70 animal-drawn harrows, 80 hand harrows, 80 threshers, 135 plows and 155 hoes. These 100 farms had a total of 117 *chia*. Comparisons among land classes by regions are shown in Table 27.

Table 27. Number of Work Animals and Equipment Items per 100 farms, by Economic Land Classes, Four Townships in the Taipei Area, 1961.

Economic land class	Rice 1	Rice 2	Rice 3	Rice 4	Upland 3	Upland 4
Total area operated	117	103	116	142	170	168
Item			Number per 100 farms			
Work animals	41	54	66	38	21	17
Ox-carts	2	4	3	--	--	--
Power tillers	6	4	5	--	5	--
Cycle trailers	69	67	24	6	11	5
Plows	139	108	71	81	68	51
Threshers	81	69	79	38	32	18
Winnowing Machines	30	34	43	31	21	19
Sprayers	67	47	17	13	5	10
Hand harrows	84	48	71	31	126	24
Animal-drawn harrows	74	41	53	44	105	17
Hoes	158	146	284	125	442	270

IX. Crop yields by economic land classes

In the Rice Region, the typical cropping system was a crop of rice in the spring, a second crop of rice in the fall and a winter crop on about 10 to 15 percent of the total area of paddy land (Table 29).

The average yield of the first crop of rice was about 3,000 kilograms 1/ per chia for Economic land Class 1 as compared with 2,300 kilograms for Land Class 4 (Table 28). The average yield of the second crop of rice was about 5 percent lower than of the first crop of rice.

Land Class 1 was more intensively used. The percentage of paddy land used for winter crops in this land class was 15.5 percent, compared with about 10 percent in Land Classes 3 and 4. Among four land classes, the highest value of winter crops per chia of paddy land was in Land Class 1 in the amount of N.T.$4,493. Land Class 1 produced winter crops about equal to one-half a rice crop, but in Land Class 2 they were equal to only one-fourth a rice crop, and in land classes 3 and 4, only one-eighth of a rice crop.

The productivity of various land classes was reflected in the value of winter crops per chia used for winter crops. One chia of land produced winter crops valued at about N.T.$29,000 in Land Class 1, N.T.$21,000 in Land Class 2, N.T.$10,000 in Land Class 3 and N.T.$8,000 in Land Class 4 (Table 29). Although vegetables require more labor, more fertilizer, and more risk taking, those farmers whose land is adapted to vegetables usually find it profitable to grow vegetables over a period of years.

Table 28. Crop Yields Per Chia of Paddy Land, by Economic Land Classes in the Rice Region, Four Townships in the Taipei Area, 1961. 1/

Economic land class	Average size of farms	Crop production per chia of paddy land 2/ Rice 1st crop	Rice 2nd crop	Winter crop	2nd crop as a percent of 1st crop
	(chia)	(kg)	(kg)	N.T.$	%
Rice 1	1.17	2,995	2,885	4,496	96
Rice 2	1.03	2,866	2,747	2,873	96
Rice 3	1.16	2,727	2,692	1.028	98
Rice 4	1.42	2,349	2,122	925	90

1/ One kilogram equals 1.68 catties (Taiwan).

2/ Data weighted by the area of the paddy land of the sample farms.

Table 29. Winter Crops on 172 Farms, by Economic Land Classes, in the Rice Region, Four Townships in the Taipei Area, 1961.

Economic land class	Area of paddy land	Area used for winter crops	Percentage of paddy land used for winter crops	Total value of winter crops	Value of winter crops per chia of paddy land	Value of winter crops per chia of land used for winter crops
	(chia)	(chia)	%	N.T.$	N.T.$	N.T.$
Rice 1	34.83	5.40	15.50	156,590	4,496	28,998
Rice 2	79.03	10.69	13.53	227,042	2,873	21,239
Rice 3	42.22	4.09	9.69	43,416	1,028	10,615
Rice 4	7.33	0.80	10.91	6,780	925	8,475

Table 30 shows the crop income per *chia* by economic land class and size of farm in the Rice Region.

Table 30. Crop Income Per *Chia* in the Rice Region by Economic Land Classes, Four Townships in the Taipei Area, 1961

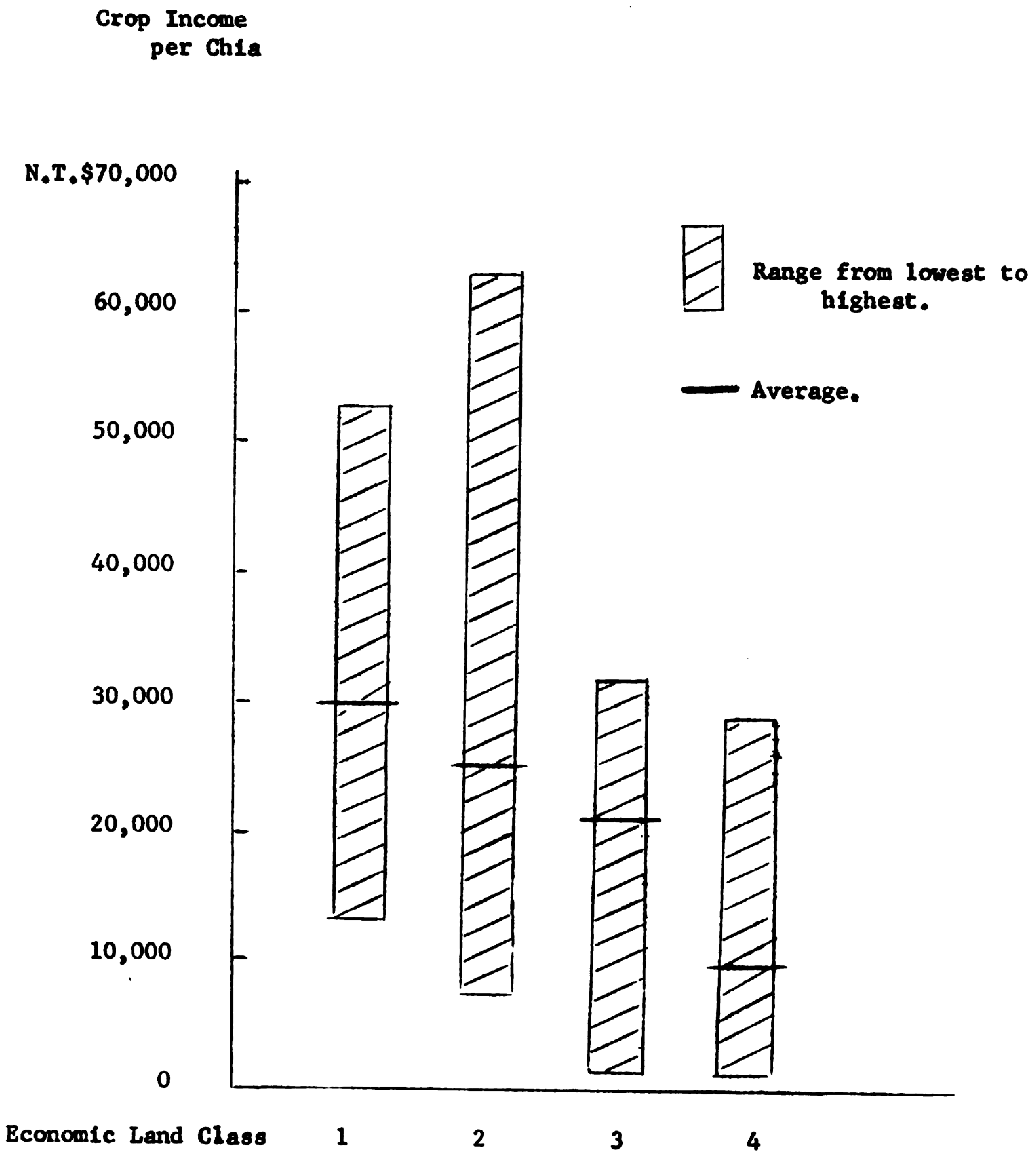
Land class	Economic land class 1	Economic land class 2	Economic land class 3	Economic land class 4
Size of Farm -	All Land Classes weighted by Chia			
	N.T.$	N.T.$	N.T.$	N.T.$
Very large	25,395	22,405	13,114	5,931
Large	28,996	25,074	21,707	8,115
Medium	33,957	27,115	21,761	10,799
Small	32,345	25,192	16,694	19,402
All sizes weighted by chia.				

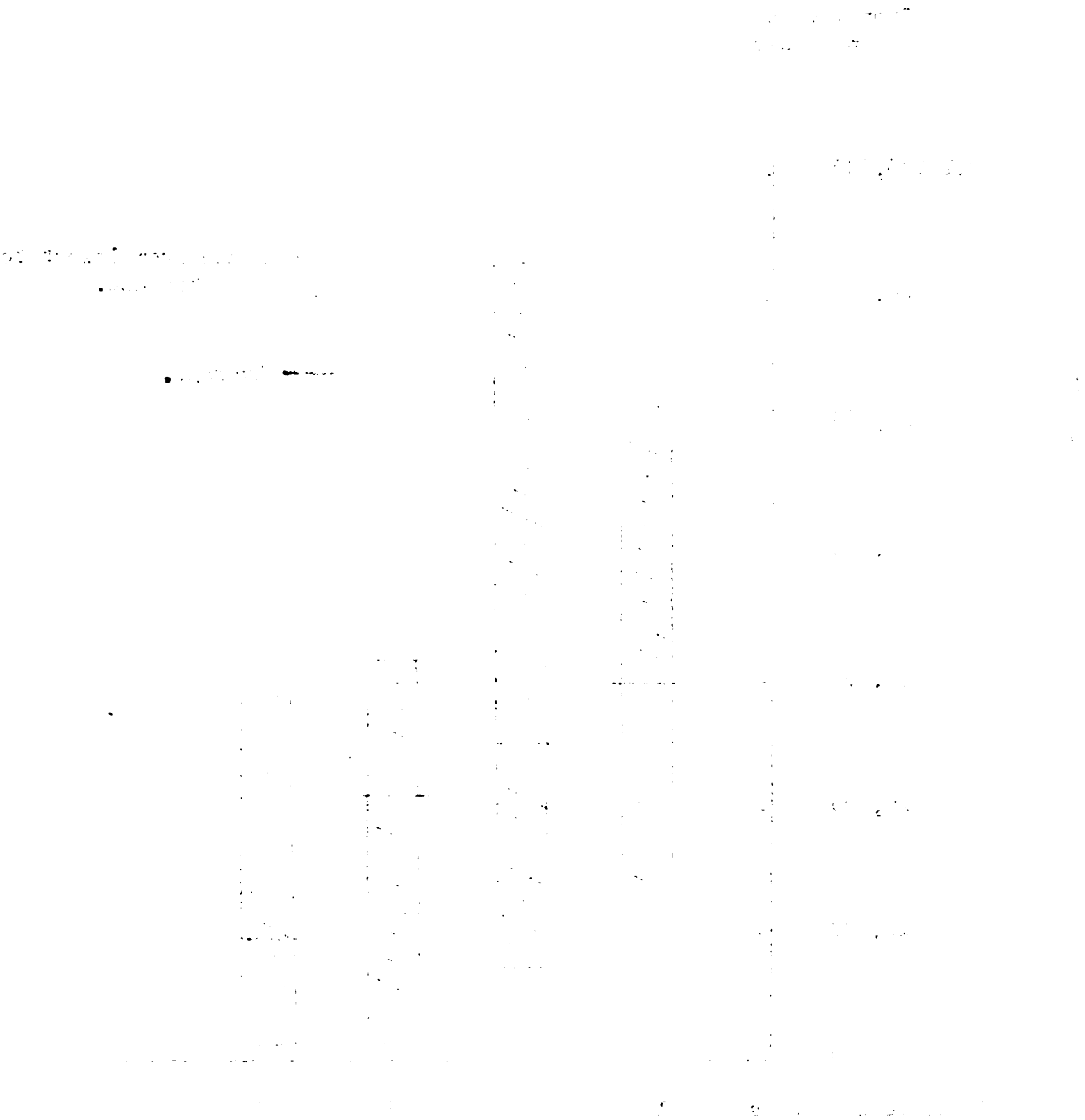
Economic Land Class 1 with a high yield of rice and winter crops per *chia* had a high crop income, an average of about N.T.$ 30,000 per *chia*. Crop income per chia of economic land classes 2, 3 and 4 was N.T.$25,000, 20,000 and 10,000, respectively. Ranges and averages of crop income per *chia* of the four economic land classes are shown in Fig. 4.

Within Land Classes 1 and 4, especially 4, the small farms apparently had the highest crop production per *chia*. No relationship is apparent in Land Classes 2 and 3.

The results of the analysis of variance among economic land classes and within the class stratified by size of farm show that the ratio of variance among classes, 26.68, is far greater than the F-value of the F-distribution, 6.992, with degrees of freedom 3 and 9, and a 1 percent significance level. This means that there are statistically significant differences in the crop income per *chia* among economic land classes at the probability level of 99 percent.

Figure 4
Ranges and Averages of Crop Income per Chia
by Economic Land Classes in the Rice Region,
Four Townships in the Taipei Area, Taiwan, China, 1961





Within economic land classes, the differences are not significant at the probability of 99 percent and just meet the standard test or the level of 95 percent of probability (Table 31).

Table 31. An Analysis of Variance in Crop Income per Chia among Economic Land Classes and Within each Class by Size of Farm, Four Townships in the Taipei Area, 1961. 1/

Source of variation	Sum of squares	Degrees of freedom	Variance	Ratio of variance	99 percent table value F	95 percent table value F
Among classes	822,469,407	3	274,156,436	26.68	6,992	3,863
Within classes	119,718,450	3	39,906,150	3.88		
Residual	92,465,841	9	10,273,982			
Total	1,034,653,598	15				

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1. See Frank A. Pearson and Kenneth R. Bennett, Statistical Methods Applied to Agricultural Economics, Chapter 19, "The Analysis of Variance", pp. 345.

The correlation coefficient, r, equals - 0.80, also showing the degree of relationship between crop income per *chia* and economic land class. This is a relatively high correlation. The negative sign means, that the higher the number of the economic land class, the lower the crop income per *chia*.

X. Land tenure and operators' education by land classes.

Table 32 shows the distribution of the sample farms by owner, part-owner, and tenant; and the education of operators. Full-owners were found more frequently in Land Classes 1 and 2. The reverse was true for part-owners.

A relationship between land classes and operators' education is apparent. Operators in Land Class 1 had more formal education than operators in other land classes. Three fourths of the farmers in Land Class 1 had attended primary school, while in Land Class 4 of the Rice Region, one-half of the operators had not attended primary school. The level of education in Land Classes 2 and 3 was about the same but a little higher than in Land Class 4 and lower than in Land Class 1. The same tendency appeared within the Upland Region.

There are greater opportunities for farmers who have had an education to use it on the better land. The better land also provides more income out of which to support the cost of an education. Since the farmers are probably operating the farms where they grew up, the past productivity of the land probably is reflected in the differences in the formal education of present operators.

Table 32. Tenure Status and Operators' Education, 250 Farms, by Economic Land Classes, Four Townships in the Taipei Area, 1961.

Economic land class	Total number of farms	Owners		Part-owners		Tenants		Operators' education					
								No school		Primary		Junior middle school	
		Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Rice 1	33	20	60	12	37	1	3	6	18	25	76	2	6
Rice 2	85	44	52	28	33	13	15	26	30	56	66	3	4
Rice 3	38	31	82	4	10	3	8	12	31	25	66	1	3
Rice 4	16	11	69	3	19	2	12	8	50	8	50	0	0
Upland 3	19	11	58	3	16	5	26	7	37	11	58	1	5
Upland 4	59	50	85	5	8	4	7	32	54	23	39	4	7

Chapter IV

Variations Among Farms in the Same Region and Land Class

I. Size of farm

In Taiwan, farms are relatively small and land is frequently a limiting factor. According to the data prepared by the township offices for the 1960 agricultural census, 29 percent of the farms in this study area were smaller than 0.5 chia, 29 percent were between 0.5 and 1 chia, and only a few of the farms, about 16 percent, were larger than 2 chia. Farms in the area studied averaged 1.06 chia. Farms in Shan-hsia Township were a little larger than farms in the other three townships because of the difference in land use pattern. Table 33 shows the distribution of farms by size.

Table 33. Distribution of Farms in Different Size Groups, Four Townships, Taipei Area, 1960.

Area (Chia)	Shin-chung	Shu-lin	Ying-ko	Shan-hsia	Total	
					Farms	Percent
0 - 0.5	344	561	396	798	2,099	29.32
0.5 - 1.0	477	487	279	822	2,065	28.84
1.0 - 1.5	326	307	171	603	1,407	19.65
1.5 - 2.0	144	153	90	412	799	11.16
2.0 - 2.5	74	57	39	200	370	5.17
2.5 - 3.0	15	32	22	120	189	5.64
3.0 - 3.5	11	16	8	65	100	1.40
3.5 - 4.0	0	6	11	40	57	0.80
4.0 - 5.0	2	3	3	20	28	0.40
4.5 - 5.0	0	2	2	7	11	0.15
5.0 - 5.5	0	2	3	26	31	0.43
5.5 - 6.0	0	3	0	0	3	0.04
Total	1,393	1,629	1,024	3,113	7,159	100.00
Average area (chia)	0.97	0.94	0.92	1.20	1.06	------
Standard deviation	0.63	0.90	0.86	1.00	0.92	------

* Data were prepared by the township offices based on the agricultural census of 1960.

The low income of Taiwan farmers is frequently attributed to the small size of their farms. Nearly all farm management studies, including this study, show that farm income is associated with farm size. There are several possibilities for the farmers to increase the size of farms. The cropping area can be increased by more double and inter-cropping. Volume of business can be increased by increased yields of crops and by adding livestock.

Migration to cities can likewise result in an increase in the resources available to the remaining farm population. The present rate of industrialization in this study area is relatively high but may not be fast enough to absorb the surplus rural population in the future. It is advisable to provide a good economic climate for the development of industries in this area.

Farms in the four economic land classes of the Rice Region were classified as very large, large, medium-sized and small farms. A similar classification into large, medium and small farms was made for the Upland Region. Size classes in this study are as follows:

	Rice Region	Upland Region
Very large	1.35 chia and over	------------
Large	0.95 to 1.34 chia	2.5 chia and over
Medium	0.55 to 0.94 chia	1.25 to 2.40 chia
Small	0.54 chia and under	1.24 chia and under

The size stratification was determined after reviewing previous farm management studies and the township data by agricultural regions.

II. Intensity of land use by size of farm within land class

Within the land class, the relationship of measures of intensity of use to size of farm were not entirely consistent, probably partly because the number of cases in some size groups is small, but large farms tended to be less intensively used than small farms. (Table 34). In Land Classes 1 and 2, small farms were equipped with less total fixed capital per farm than medium-sized farms; but on a per _chia_ basis small farms used more fixed capital than farms of larger size groups. This could, of course, be described as a difference in capital efficiency. This is because smaller farms usually have a minimum need for buildings, for example, a house for family living. Some of the house (and land on which it is built) should not be included as an indication of intensity of agricultural use if the family includes off-farm workers.

Work days per _chia_ were also higher for small farms than other sizes of farm.

Variable costs applied to a unit of farm land in terms of total cash expenses including hired labor expense, fertilizer expense and the like, appeared highest for the medium farms, in land classes 1 and 2. In Land Class 3 and 4, small farms used more variable costs than other sizes of farm, and fixed capital and work days per _chia_ tended to be greater on the smaller farms, though the trend was variable.

Gross farm earnings; which included gross farm receipts and farm privileges, had the same tendency as the total cash expenses, that is, the highest amount per chia occurred on small farms in Land Classes 1 and 2 and medium sized farms of Land Classes 3 and 4. Very large farms provided the lowest gross farm earnings per chia in all land classes. In Land Class 2, where the sample of farms was larger than in other land classes, the variation in gross farm earnings per chia among sizes of farm was not large.

Table 34. Intensity of Land Use by Size of Farm within Land Classes, the Rice Region, Four Townships near Taipei, 1961.

Land Class	Size of farm	Number of farms	Per Chia			
			Work days	Fixed capital	Total cash expenses	Gross farm earnings
				N.T.$	N.T.$	N.T.$
1	Very large	7	242	131,654	14,351	31,642
	Large	10	330	199,228	15,729	37,012
	Medium	9	430	211,208	24,579	51,641
	Small	7	625	359,940	19,344	46,997
2	Very large	30	263	121,875	12,733	31,433
	Large	18	325	129,591	17,290	33,415
	Medium	25	371	139,698	18,002	40,228
	Small	12	498	172,911	16,097	33,076
3	Very large	19	166	73,126	9,218	18,862
	Large	9	315	119,166	14,076	29,859
	Medium	7	256	87,166	10,344	28,035
	Small	3	393	84,856	17,423	32,863
4	Very large	8	127	40,344	3,728	9,013
	Large	2	325	86,122	3,216	14,990
	Medium	4	274	88,877	6,968	14,281
	Small	2	593	44,446	9,648	28,223

III. Crop yields by size of farm within land classes.

The size of farm, measured by area, was not related to crop yields (Table 35). The average yields on paddy land for different size groups within each land class were remarkably stable for rice. In Land Class 1 the winter crop showed a trend with the smaller farms producting more winter crop per chia of paddy land, than the larger farms. Most of the production on these farms probably was used by the farm family for home consumption, and its market value in N.T. dollars is difficult to estimate.

Very large farms usually received lower crop income per chia than smaller farms in all land classes in the rice region. As a whole, however, a relationship between crop yields and size of farms is not apparent. Its correlation coefficient was only -0.32.

An analysis of variance for crop income per chia by size of farm within land classes was reported in Table 31 of chapter III. It showed that the differences within land classes were not significant at the 1 percent level and were barely significant at the 5 percent level of probability.

Table 35. Crop Yields and Crop Income by Size Farms Within Land Classes, Rice Region, Four Townships near Taipei, 1961

Land class	Size of farm	Average size (chia) 1/	No. of farms	Crop production per chia of paddy land			Crop income per chia (NT$) 2/
				Rice 1st crop (kg)	Rice 2nd crop (kg)	Winter crop (NT$)	
1	Very large	2.80	7	2,928	2,967	4,081	25,395
	Large	1.17	10	2,812	2,550	3,687	28,996
	Medium	0.71	9	3,514	3,276	5,655	33,957
	Small	0.38	7	2,983	2,891	7,845	32,345
2	Very large	1.95	30	2,818	2,763	3,237	22,405
	Large	1.14	18	2,913	2,751	1,536	25,074
	Medium	0.77	25	2,917	2,702	3,945	27,115
	Small	0.36	12	2,972	2,724	854	25,192
3	Very large	2.68	19	2,734	2,701	1.133	13,144
	Large	1.15	9	2,678	2,859	803	21,707
	Medium	0.68	7	2,751	2,706	1,004	21,761
	Small	0.39	3	2,995	2,668	-----	16,694
4	Very large	2.71	8	2,487	2,234	1,614	5,931
	Large	1.26	2	2,100	1,920	-----	8,115
	Medium	0.74	4	2,324	2,185	-----	10,799
	Small	0.42	2	1,650	1,200	-----	19,402 3/

1/ For components of area, see Tables 2 and 3.

2/ Crop income per chia includes income from rice, winter crops and the crops other than rice.

3/ Almost half of the income was from vegetable fields and tea gardens.

IV. Income data by size of farm within land class

Table 36 shows many income measures revealing the differences of income among sizes of farm. The differences are significant. Larger farms tend to receive higher incomes than smaller farms. The trend is evident, especially in family farm earnings, which has been discussed in the previous chapter describing economic land classes.

The results of the analysis of variance show that both size of farm and economic land class are important factors influencing the net incomes of farm families. In this study, size of farm has more influence on net income of farm families than economic land class, but both factors are very influential.

Family farm income, which reflects the commercial side of farming, shows strong relationship with size of farm in most land classes except Land Classes 3 and 4 in the Rice Region. Labor and capital earnings per man also shows a strong relationship with size of farm. The income measures have a better relationship with size of farm on the better land than on the poorer land of the same region. It pays better to increase the size of farm on good land than on poor.

Table 36. A Comparison of Different Measures of Net Income Per Farm, Agricultural Regions, Land Classes and Sizes of Farm, 250 Farms, Four Townships near Taipei, 1961.

Region & land class	Size of farm	Family farm income	Family income	Family farm earnings	Family earnings	Labor & capital returns per man	Labor & capital earnings per man
		(NT$)	(NT$)	(NT$)	(NT$)	(NT$)	(NT$)
Rice 1	Very large	26,487	77,758	45,653	96,924	6,816	10,983
	Large	12,740	18,030	23,643	28,933	4,492	7,496
	Medium	6,518	23,634	17,733	34,849	2,927	6,356
	Small	4,506	8,775	9,815	14,084	2,069	4,159
Rice 2	Very large	18,910	24,113	34,856	40,059	5,171	9,023
	Large	4,996	9,614	17,008	21,626	1,968	5,352
	Medium	7,015	13,549	15,737	22,271	3,184	6,394
	Small	510	10,141	5,405	15,036	632	2,715
Rice 3	Very large	8,735	13,224	24,115	28,604	3,445	7,590
	Large	6,106	10,755	17,558	22,207	2,560	6,095
	Medium	10,950	15,119	10,950	22,616	2,311	5,885
	Small	1,589	15,389	5,685	19,485	1,569	3,702
Rice 4	Very large	5,413	9,543	13,501	17,631	1,527	3,374
	Large	8,590	11,565	14,063	17,038	2,399	3,828
	Medium	321	4,471	5,034	9,184	318	2,084
	Small	4,149	18,449	7,418	21,718	2,942	4,645
Upland 3	Large	30,332	33,092	43,209	45,969	10,126	13,033
	Medium	20,376	29,346	26,425	35,395	7,527	9,664
	Small	2,288	10,589	3,519	11,820	1,240	1,618
Upland 4	Large	13,064	25,887	19,247	32,070	4,102	5,655
	Medium	6,689	13,769	10,929	18,009	3,114	4,771
	Small	3,076	13,844	4,513	15,281	1,664	2,362

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V. General business summary

Farms very greatly in their relative financial success depending upon quality of the land resources and other characteristics, especially size of area operated. Gross farm receipts, mostly from the farm production, were, of course, higher on large than small farms (Table 37). Larger farms supported more persons and provided a larger amount of farm privileges than small farms. The differences in land class affected the commercial income of the farm (the gross farm receipts) much more than the non-commercial income (the farm privileges). Also, differences in size of farm within the land class affected the commercial more than the non-commercial income.

Off-farm income, in Land Classes 2 and 3, appeared to be higher on small farms than large farms. It is reasonable that small farms need more money from off-farm work in order to subsidize the small amount of gross farm receipts to meet the farm and family expenses.

In all land classes except Land Class 1, the importance of the gross farm receipts as a percentage of gross family earnings decreased as the size of farm decreased and the off-farm income increased in importance (Table 38). The larger the farms and the better the land the higher the amount of gross family earnings. Because more than 50 percent of the gross family earnings come from gross farm receipts, the higher gross farm receipts are reflected in the higher family earnings by size of farm within each land class and among land classes except on small farms. Family earnings for the small farms did not show much difference among land classes in the Rice Region in constrast to other farm sizes. This is because the small amount of gross farm receipts, which come from small farms, had little influence on farmily earnings which are also influenced by non-farm income.

The first requirement for the success of the farm business is an acceptable family living. The family living values were higher on the very large farms of each land class than on smaller farms. This is partially because the large farms usually support more persons per farm.

The second requirement for the success of the farm business is sufficient income to pay farm expenses for production. Farm expenses increased as the size of farm increased. Very large farms in Land Class 1 spent five times as much as small farms. Gross farm receipts on very large farms were also five times as much as those on small farms. Off-farm income of these very large farms was also much higher than it was for other size groups in Land Class 1. The reverse tended to be true in other land classes with small farms showing the largest off-farm income.

In summary, in the Rice Region, Land Class 1 farms had residual amounts available for debt retirement or capital accumulation. Upland farms of large and medium size on Land Class 3 also showed a calculated surplus above all expenses. Within Land Class 2, Rice, only very large farms showed such a residual amount. Most of the groups of farms showed small negative results which become larger in sequence as the lands become poorer. As a matter of fact, the farmers continue to operate their farms, however. This may be an indication of a poor year or more probably, the negative results were caused by under estimation of the non-cash farm receipts or over estimation of the non-cash farm expenses. For example, the value of increase in inventory might be under estimated, especially the estimated value of farm crops like the increasing value of citrus trees in the orchards, charcoal trees on the hills,and the like. On the other hand, depreciation of capital might be over-estimated. All of these non-cash estimates influence the calculated residual. It is not necessarily true, therefore, that the operations of these farms were not profitable. It is also possible that the off-farm income might be under-reported. In fact, most of the farmers in this study area still could afford to send their children to middle or high school and operate the farm business. Many farmers are trying to send their children to cities to work in the industries. For the entire group of farms the average amount of surplus available for investment or debt retirement per farm was about 1,700 N.T. dollars for both the Rice and Upland regions.

In this study of economic land classification, data showing the amounts of income and expense indicate the relative success of farm businesses among land classes and sizes of farm. Land Class 1 was most successful, especially on very large farms. Land Class 4 provides a living but accumulating capital is difficult. Within the same agricultural region incomes decrease with decreases in size of farm on all land classes.

It appears to the author that many farm families in this area are improving their level of living. Children are sent to middle school and high school, farming techniques are improving as indicated by an increase in the use of fertilizers and insecticides. A few power-tillers are making their appearance on the large farms in the best areas. Community improvements, included the expansion and improvement of all-weather truck roads, marketing facilities of all kinds, schools and other public buildings, are also in evidence.

The community improvements can be achieved more easily in the Rice Region than in the Upland Region because of a more dense population per square kilometer of area.

Table 37. A Summary of Business Data Per Farm Household By Economic Land Class and Size of Farm, 250 Farms, Four Townships near Taipei, 1961

Region, land class, & size	1 Gross farm receipts (NT$)	2 Farm privileges (NT$)	3 Off-farm income (NT$)	1+2+3=4 Family earnings (NT$)	5 Family living value (NT$)	6 Farm expense 1/ (NT$)	4-5-6=7 Amount available for investment or debt retirement (NT$)
Rice 1							
Very large	69,475	19,166	51,271 2/	139,912	72,008	42,988	24,916
Large	32,548	10,903	5,290	48,741	22,817	19,808	6,116
Medium	25,278	11,215	17,116	53,609	25,462	18,760	9,387
Small	12,751	5,309	4,269	22,329	13,637	8,245	447
Rice 2							
Very large	45,495	15,946	5,203	66,644	33,205	26,585	6,854
Large	25,988	12,012	4,618	42,618	23,093	20,992	- 1,467
Medium	22,125	8,722	6,534	37,381	22,628	15,110	- 357
Small	6,902	4,895	9,631	21,428	17,111	6,392	- 2,075
Rice 3							
Very large	35,122	15,380	4,489	54,991	31,446	26,387	- 2,842
Large	22,786	11,965	4,649	39,400	24,524	16,680	- 1,804
Medium	11,686	7,497	11,666	30,849	22,845	8,233	- 229
Small	8,611	4,096	13,800	26,507	19,483	7,022	2
Rice 4							
Very large	16,327	8,088	4,130	28,545	21,866	10,914	- 4,235
Large	13,416	5,473	2,975	21,864	19,970	4,826	- 2,932
Medium	5,856	4,713	4,150	14,719	12,884	5,535	- 3,700
Small	8,444	3,269	14,300	26,013	20,930	4,295	788
Upland 3							
Large	69,085	12,877	2,260	84,722	34,848	38,753	11,321 3/
Medium	29,091	6,049	8,970	44,110	23,358	8,715	12,037 4/
Small	5,893	1,231	8,301	15,425	13,095	3,605	- 1,275
Upland 4							
Large	29,131	6,183	12,823	48,137	31,093	16,067	977
Medium	14,124	4,240	7,080	25,444	18,768	7,435	- 759
Small	7,404	1,437	10,768	19,609	15,550	4,328	- 269
Rice region	23,671	9,693	9,340	42,704	24,914	16,098	1,692
Upland region	15,589	3,352	8,726	27,667	18,198	7,789	1,680

1/ Farm expense does not include estimated value of unpaid family labor and operator's labor, and interest charge on investment.

2/ Average persons living on the farm was 16 persons, of whom two persons were running commercial business.

3/ The amount is affected by the extraordinary samples of large farms. (average 8.01 chia).

4/ The amount represents the average of five farms near a coal mine.

Table 38. Farm Receipts, Farm Privileges and Off-farm Income Compared as a Percent of Gross Family Earnings, By Agricultural Regions, Land Classes and Sizes of Farm, Four Townships near Taipei, 1961.

Region, land class & size of farm		Gross farm receipts %	Farm privileges %	Off-farm income %	Gross family earnings %
Rice I	Very large	50	14	36	100
	Large	66	22	12	100
	Medium	47	21	31	100
	Small	57	24	19	100
Rice II	Very large	68	24	8	100
	Large	61	28	11	100
	Medium	59	23	18	100
	Small	32	23	45	100
Rice III	Very large	64	28	8	100
	Large	58	30	12	100
	Medium	38	24	38	100
	Small	32	15	53	100
Rice IV	Very large	57	28	15	100
	Large	61	25	14	100
	Medium	40	32	28	100
	Small	32	13	55	100
Upland III	Large	82	15	3	100
	Medium	66	14	20	100
	Small	38	8	54	100
Upland IV	Large	61	13	26	100
	Medium	56	27	27	100
	Small	38	7	55	100

VI. Labor efficiency

Crop area per man-equivalent is one measure of labor efficiency. It varied by size of farm. On very large farms, one man-equivalent operated one and one-half chia of crop area as compared to one-half chia of crop area per man equivalent on small farms (Table 39). The significance of this measure is affected by the varying proportion of crops with high or low labor requirements. Therefore, it is not suitable for comparison between agricultural regions which have different patterns of land use; but it is a good measure to show the labor efficiency within agricultural regions, especially in the same land class.

Working days per man-equivalent is also a good measure of labor efficiency for all types of farms and for different agricultural regions. The Upland Region seemed more efficient in the use of labor than the Rice Region. On the average, one man-equivalent in the Rice Region worked on the farm about 150 work dyas per year as compared with 200 work days per year in the Upland Region. But in the Rice Region, within a land class, it was difficult to find a relationship with size of farm.

The total labor expense per chia was higher on small farms than on the medium, large and very large farms. It is apparent that larger farms use the labor more efficiently than small farms. When an index was prepared to compare the labor efficiency among sizes of farm, very large farms in the Rice Region, and large farms in the Upland Region, turned out to be the most efficient in the use of labor. Large farms in the Rice Region and medium farms in the Upland Region were close to the average in efficiency. But medium and small farms in the Rice Region and small farms in the Upland Region were below average in efficiency. Labor and capital earnings per man, which is affected by capital efficiency in its calculation, is a measure of net earnings. It showed the same tendency as the measures of labor efficiency.

Thus, the conclusion is reached that the larger the size of these family-operated farms, the higher the labor efficiency and net earnings per man. Farmers who can increase the size of their farms may therefore be able to improve their labor efficiency and net earnings.

VII. Capital efficiency

Earnings on capital investment were very low as calculated in this study. This is a residual measure of income and may reflect mistakes in estimates, especially, estimates of the value of the labor of the operator and unpaid family members. The figures are mostly negative with only a few positive.

The rate, however, is relatively higher on the very large farms on the best land than it is on small farms in less productive areas (Table 40).

Gross farm receipts as a percent of total fixed capital measures rate of capital turnover. It ranged from 15 to 19 percent in the Rice Region and 19 to 24 percent in the Upland Region. It is interesting that the highest rates of capital turnover within land classes shift from very large farms to small farms as the land becomes poorer. Off-farm income may be a factor.

Table 39. Labor Efficiency and Labor and Capital Earnings Per Man by Agricultural Regions, Land Classes and Sizes of Farm, 250 Farms, Four Townships near Taipei, 1961

Region & land class	Size of farm	Crop area per man equivalent	Work days per man equivalent	Total labor expense per chia 1/	Labor efficiency index 2/	Labor & capital earnings per man
		(chia)		(NT$)		(NT$)
Rice 1	Very large	1.57	189	8,488	134	10,983
	Large	0.97	147	11,973	95	7,496
	Medium	0.66	134	15,271	74	6,356
	Small	0.53	159	19,425	58	4,159
	Average	1.04	159	11,341	100	7,462
Rice 2	Very large	1.24	164	10,041	112	9,023
	Large	0.92	145	11,096	101	5,352
	Medium	0.92	167	12,099	93	6,394
	Small	0.57	132	16,280	69	2,715
	Average	0.97	153	11,223	100	6,198
Rice 3	Very large	1.57	163	6,297	132	7,590
	Large	1.01	161	9,329	89	6,095
	Medium	1.10	136	10,622	78	5,585
	Small	0.63	165	13,780	60	3,702
	Average	1.18	158	8,309	100	5,920
Rice 4	Very large	1.03	102	4,034	155	3,374
	Large	0.63	145	8,917	70	3,828
	Medium	0.74	122	8,749	71	2,084
	Average	0.90	136	6,247	100	3,555
Upland 3	Large	3.06	238	3,489	71	13,033
	Medium	1.37	215	5,721	100	9,664
	Small	0.58	173	11,761	49	1,818
	Average	1.40	201	5,741	100	6,120
Upland 4	Large	1.99	212	2,955	155	5,655
	Medium	1.40	203	5,219	68	4,771
	Small	1.15	189	5,666	81	2,362
	Average	1.43	199	4,589	100	3,828

1/ The total labor expense includes hired labor and estimated value of family and operator's labor.

2/ The labor efficiency index is the percent which the average labor expense per chia of the given land class and region is of the labor expense per chia of the various size groups in the same land class and region.

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Table 40. Capital Efficiency By Agricultural Regions, Land Classes and Sizes of Farm, 250 Farms, Four Townships near Taipei Area, 1961.

Region & land class	Size of farms	Total fixed capital	Gross farm receipts	Rate of capital turnover a/	Net return to farm capital b/	Rate of return on farm capital
		(NT$)	(NT$)	(Percent)	(NT$)	(Percent)
Rice 1	Very large	368,819	69,475	18.8	7,580	2.1
	Large	233,894	32,548	13.9	2,250	1.0
	Medium	149,254	25,278	16.9	-1,222	-0.8
	Small	138,320	12,751	9.2	-2,210	-1.6
Rice 2	Very large	238,223	45,495	19.1	1.783	0.7
	Large	147,373	25,988	17.6	-5,631	-3.8
	Medium	107,197	22,988	21.4	729	0.7
	Small	61,672	6,902	11.2	-4,322	-7.0
Rice 3	Very large	195,784	35,122	17.9	-4,004	-2.0
	Large	136,644	22,786	16.7	-2,400	-1.8
	Medium	59,901	11,686	19.5	-1,976	-3,3
	Small	32,811	8,611	26.2	-2,316	-7.1
Rice 4	Very large	109,282	16,327	14.9	-4,238	-3.9
	Large	108,514	13,416	12.4	-2,045	-1.9
	Medium	65,769	5,856	8.9	-5,624	-8.6
	Small	18,445	8,444	45.8	- 606	-3.3
Upland 3	Large	402,195	69,085	17.2	16,910	4.2
	Medium	82,864	29,091	35.1	9,985	12.0
	Small	19,457	5,893	30.3	-3,383	-17.4
Upland 4	Large	177,866	29,131	16.4	1,459	0.8
	Medium	75,617	14,124	18.7	-1,291	-1.7
	Small	33,614	7,404	22.0	-1,817	-5.4

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a/ Percent that receipts are of farm capital.

b/ This measure has been defined on page 5, chapter I.

Chapter V

Relationships of Income to Capital and of Expenses to Income

I. Relation of income to capital

Tables 41, 42, and 43 show the percentage relationship of several measures of income to fixed capital for the 250 farms in this study, arranged by region and by economic land class and size within each region.

Family farm income was about 5 or 6 percent of fixed capital in most land classes, and for most sizes of farms in the Rice Region; but the percentage increased to 11 percent in the Upland Region (Table 41). This difference is due to the relatively greater importance of farm privileges in the Rice Region compared with the Upland Region.

Family income, which includes off-farm income but not farm privileges, was about 12 percent of fixed capital in the Rice Region and about 23 percent in the Upland Region.

Net return to farm capital, a residual measure of income to capital, was a poor measure to use when estimating market value of fixed capital. It tended to be negative for most farms and most groups, and was not uniform among groups.

Operator's labor income and Operator's labor earnings had the same fault as net return to farm capital. They did not show a consistent relationship with farm capital and were often a negative quantity.

Table 42 shows non-residual measures of income per farm or family, as percentages of fixed capital. Gross farm earnings was about 24 and 27 percent of fixed capital in the Rice Region and Upland Region, respectively.

Farm cash expenses are usually not thought of as an income measure, but from the viewpoint of those to whom they are paid they are income. Farm cash expenses equaled 10 to 11 percent, on the average, of the fixed farm capital in the two agricultural regions.

Family farm earnings, as a percent of fixed capital, ranged from 11 to 14 percent by land classes in the Rice Region, and averaged about 16 percent in the Upland Region.

Family earnings were about 18 to 24 percent of capital in the Rice Region and about 28 percent in the Upland Region.

Table 43 presents income-capital relationships for net incomes calculated on a per man or per worker basis. In the Rice Region, labor and capital returns per man was a larger percent of fixed capital in the poor land areas than on the good land. The percent varied from 2.0 percent in Land Class 1 to 2.5 percent in Land Class 4. On the average, the percentage in the Upland Region was twice as much as the percentage in the Rice Region. This was probably because farm privileges, which are not included in this measure of income, were more important in the Rice than in the Upland Region.

Labor and capital earnings per man, which include farm privileges, showed a relatively constant relation to fixed capital and was about 3.5 to 7.9 percent of fixed capital. Of the twenty-one land-class and size groups studied, fourteen averaged between 3 and 5 percent.

Labor earnings per man equivalent was calculated by adding the incomes of the operator, family labor and hired men together and dividing by man-equivalent. It was about 3 percent and 6 percent of fixed capital in the Rice Region and Upland Region, respectively.

Labor and capital returns per man was less consistent in its relationship with fixed capital but averaged about 2 and 5 percent respectively, for the Rice Region and Upland Region.

Non-residual income measures, such as family farm earnings or family earnings, were more consistent in their relationship to capital than those measures of income which are of a residual nature and require estimates of value for such things as operator's labor, family labor and interest rate on capital investment. Among the various measures of income tested, labor and capital earnings per man showed the best relationship with fixed capital.

The data support the idea that total capital on the farm is proportionate to the average earnings to all of those who depend on the land for a living. Within the same agricultural region, total capital per farm tends to be the same multiple of average net earnings per man, on poor land as on good land. The difference in level of income and living between good and poor land is usually related to the larger gross available on good land compared with poor land, not to differences in the proportion distributed to different factors of production.

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Table 41. Percent that Various Income Measures Per Farm Are of Fixed Capital Per Farm, by Agricultural Regions, Economic Land Classes and Sizes of Farm, Four Townships near Taipei, 1961.

Region and land class	Income measures				
	Family farm income	Family income	Net return to farm capital	Operator's labor income	Operator's labor earnings
	Percent income is of total fixed capital				
Rice, Land Class 1					
Very large	7.2	21.1	2.1	-3.8	1.4
Large	5.5	7.7	1.0	-3.7	1.0
Medium	4.4	15.8	-0.8	-5.7	1.8
Small	3.3	6.3	-1.6	-5.5	-1.7
Average	5.5	14.1	0.5	-4.5	0.8
Rice, Land Class 2					
Very large	7.9	10.1	0.8	-4.6	2.1
Large	3.4	6.5	-3.8	-8.6	-0.4
Medium	6.5	12.6	0.68	-4.6	3.5
Small	0.8	16.4	-7.0	-9.3	-1.4
Average	5.7	10.7	-1.6	-6.2	1.5
Rice, Land Class 3					
Very large	4.5	6.8	-2.1	-6.4	1.4
Large	14.5	7.9	-1.8	-7.2	1.2
Medium	18.3	25.2	-3.3	-6.0	6.5
Small	4.8	47.0	-7.1	-11.2	1.3
Average	4.7	14.1	-2.7	-7.1	2.0
Rice, Land Class 4					
Very large	5.0	8.7	-3.9	-7.7	-0.3
Large	8.0	10.7	-1.9	-6.4	-1.4
Medium	0.5	6.8	-8.6	-10.7	-3.6
Small a/					
Average	6.6	16.1	-3.9	-6.8	0.7
Upland, Land Class 3					
Large	7.5	8.2	4.2	-1.4	1.8
Medium	24.6	35.4	12.1	10.6	17.9
Small	11.8	54.4	-17.4	-4.6	1.7
Average	12.8	22.9	2.8	1.3	6.1
Upland, Land Class 4					
Large	7.3	14.6	0.9	-4.5	-1.0
Medium	8.9	18.2	-1.7	-3.9	1.7
Small	9.2	41.2	-5.4	-3.5	0.8
Average	8.5	23.6	-2.0	-4.0	0.6
Rice Region, Average	5.5	12.3	-1.3	-5.9	1.2
Upland Region, Average	11.0	23.2	0.8	-1.0	3.8
Average rate b/	6.2	13.7	-1.0	-5.2	1.5

a/ Data omitted.

b/ Represents an average for the two regions weighted according to number of farms in each region.

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Table 42. Percent that Various Income Measures Per Farm were of Fixed Capital per Farm, By Agricultural Regions, and By Economic Land Classes and Sizes of Farm, 250 Farms, Four Townships in the Taipei Area, 1961.

Region and land class	Income measures			
	Gross farm earnings	Cash farm expenses a/	Family farm earnings	Family earnings
	Percent income is of total fixed capital			
Rice, Land Class 1				
Very large	24.0	10.9	12.4	26.3
Large	18.6	7.9	10.1	12.4
Medium	24.5	11.6	11.9	23.4
Small	13.1	5.4	7.1	10.2
Average	20.7	9.3	10.8	19.4
Rice, Land Class 2				
Very large	25.8	10.5	14.6	16.8
Large	25.8	13.3	11.5	14.7
Medium	28.8	12.9	14.7	20.8
Small	19.1	9.3	8.8	24.4
Average	25.4	11.4	13.1	18.1
Rice, Land Class 3				
Very large	25.8	12.6	12.3	14.6
Large	25.4	11.8	12.9	16.3
Medium	32.0	11.8	18.3	37.8
Small	38.7	20.5	17.3	59.4
Average	27.9	13.2	13.8	23.2
Rice, Land Class 4				
Very large	22.3	9.2	12.4	16.1
Large	17.4	3.7	13.0	15.7
Medium	16.1	7.8	7.7	14.0
Small b/				
Average	23.2	8.4	14.1	23.5
Upland, Land Class 3				
Large	20.4	9.3	10.7	11.4
Medium	42.4	9.8	31.9	42.7
Small	36.6	17.2	18.1	60.8
Average	28.9	10.7	17.6	27.7
Upland, Land Class 4				
Large	19.9	8.3	10.8	18.0
Medium	24.3	9.4	14.5	23.8
Small	26.3	11.7	13.4	45.5
Average	23.5	9.7	13.1	28.2
Rice Region	24.3	10.9	12.6	19.4
Upland Region	26.6	10.3	15.7	27.9
Average rate c/	24.6	10.8	13.0	20.5

a/ Farm cash expenses are income to off-farm people who contribute to the farm production.

b/ Data omitted.

c/ Represents an average for the two regions weighted according to number of farms in each region.

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Table 43. Percent that Various Income Measures Per Farm Person were of Fixed Capital Per Farm, by Agricultural Regions, Economic Land Classes and Sizes of Farm, 250 Farms, Four Townships in the Taipei Area.

Region and land class	Income measures			
	Labor and capital returns per man	Labor and capital earnings per man	Labor returns per man-equivalent	Labor earnings per man-equivalent
	Percent income is of total fixed capital			
Rice, Land Class 1				
Very large	1.9	3.0	0.4	1.9
Large	1.9	3.2	0.01	1.8
Medium	2.0	4.3	0.3	3.1
Small	1.5	3.0	2.1	0.4
Average	2.0	3.5	-0.07	2.2
Rice, Land Class 2				
Very large	2.2	3.8	0.6	2.7
Large	1.3	3.6	0.9	2.3
Medium	3.0	6.0	0.6	5.4
Small	1.0	4.4	3.3	2.7
Average	2.2	4.6	-0.07	3.4
Rice, Land Class 3				
Very large	1.8	3.9	-0.2	2.7
Large	1.9	4.5	-0.4	3.3
Medium	3.9	9.3	1.4	11.1
Small	4.8	11.3	2.4	15.9
Average	2.6	7.0	-0.02	5.3
Rice, Land Class 4				
Very large	1.4	3.1	0.3	1.9
Large	2.2	3.5	0.5	2.3
Medium	0.5	3.2	-3.0	1.3
Small a/				
Average	2.5	4.8	0.5	3.8
Upland, Land Class 3				
Large	2.5	3.2	1.2	2.1
Medium	9.1	11.7	10.2	14.2
Small	6.4	9.3	5.8	11.4
Average	6.0	7.9	5.4	8.5
Upland, Land Class 4				
Large	2.3	3.2	0.7	1.9
Medium	4.1	6.3	2.3	5.9
Small	5.0	7.0	3.0	7.1
Average	4.1	6.0	2.1	5.3
Rice Region	2.2	4.5	-0.04	3.3
Upland Region	5.2	7.1	4.1	7.2
Average rate b/	2.6	4.8	0.5	3.8

a/ Data omitted.

b/ Represents an average for the two regions weighted according to number of farms in each region.

II. Relation of farm expense per chia to income per chia

There was an apparent relationship between farm expense and gross farm receipts. The relationship between input and output in various farm enterprises generally follows a similar pattern. The output increases as more input is added. It is not an exception in this study; the gross farm receipts increased as farm expense was added to a given area of land. The correlation coefficients of farm expenses per chia and gross farm receipts per chia were positive for various land classes. They showed a relatively higher relationship as compared with the relation of cash expense per chia to gross farm receipts per chia. (Table 44). The correlation coefficient of farm expense to gross farm receipts was higher in Land Classes 1 and 2 than in Land Classes 3 and 4.

Table 45 shows in detail the relation of farm expense per chia to gross farm receipts per chia by averaging the gross farm receipts according to the different farm expense groups. From this table, it appears that Land Class 1 is more successful in producing net income than other land classes. For example, when 20,000 to 30,000 N.T. dollars of farm expense per chia including hired labor expense and all other sorts of cash expenses, depreciation of farm equipment, estimated value of family and operator's labor expense and also interest charge on capital are added together, gross farm receipts are 17,500, 17,200, 16,700, and 13,200 N.T. dollars for Land Classes 1, 2, 3 and 4, respectively.

The linear regression lines showing the relationship between farm expense per chia and gross farm receipts per chia for various land classes are calculated as follows:

Economic land class 1	$y_1 = 5{,}100 + 0.55\ x_1$
Economic land class 2	$y_2 = 3{,}900 + 0.54\ x_2$
Economic land class 3	$y_3 = 3{,}900 + 0.51\ x_3$
Economic land class 4	$y_4 = 1{,}700 + 0.39\ x_4$

Where x_1, x_2, x_3, and x_4 represent farm expenses per chia and y_1, y_2, y_3, and y_4 represent gross farm receipts per chia for land classes 1, 2, 3, and 4 respectively. The regression coefficients of gross farm receipts per chia on farm expenses per chia, which show the ratio of output and input, are 0.55, 0.54, 0.51 and 0.39 for land classes 1, 2, 3, and 4 respectively.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

In other words 1 N.T. dollar of farm expense applied to a farm will obtain the return of 0.55 dollars in land class 1 and so forth. It is apparent again that land class 4 is so poor that only 0.39 dollars of commercial output are obtained in response to 1 dollar of total input. The data seem to indicate that farming is not profitable but a great loss, because only 50 percent of investment is returned. As a matter of fact, however, more than 50 percent of farm expenses were the estimated value of family and operator's labor expense and interest charge on capital invested, and much of this is used in producing products consumed on the farm (farm privileges), which are not included in the receipts. A similar comparison with earnings per chia would show a different result.

The relation of farm expenses to gross farm receipts among land classes is shown in Fig. 5.

Table 44. Correlation Coefficient between expense and income, by Economic Land Classes, Rice Region, Four Townships near Taipei, 1961

Economic land class	Correlation Coefficient	
	Total farm expense per chia to gross farm receipts per chia	Cash expense per chia to gross farm receipts per chia
Land class 1	0.85	0.66
Land class 2	0.85	0.43
Land class 3	0.67	0.48
Land class 4	0.61	0.52
Total (Rice Region)	0.83	0.60

Table 45. Relation of Farm Expense Per Chia to Gross Farm Receipts Per Chia, by Economic Land Classes, Rice Region, Four Townships, near Taipei, 1961 a/

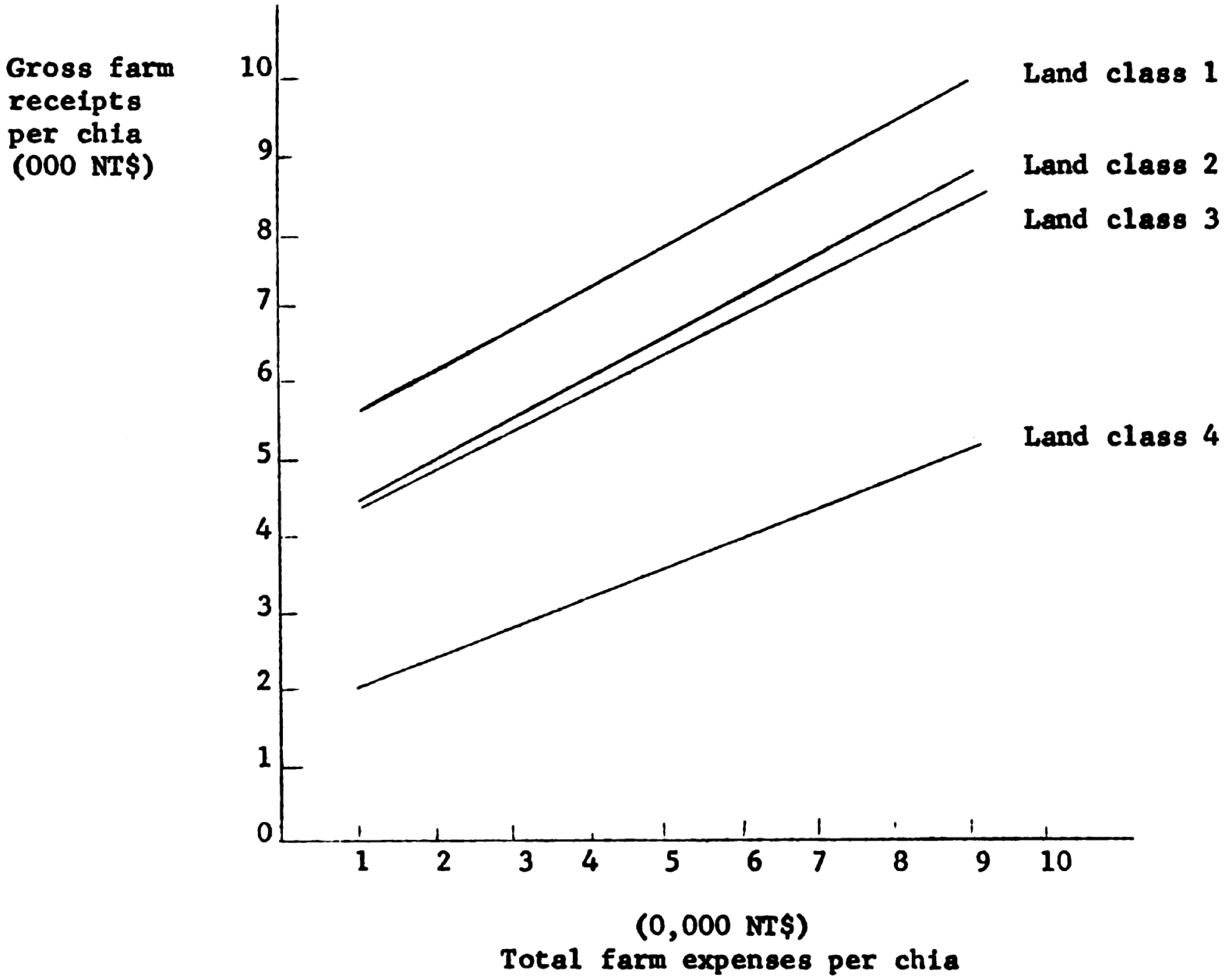
Farm expenses per chia	Total (Rice Region)	Land class 1	Land class 2	Land class 3	Land class 4
(NT$)	(NT$)	(NT$)	(NT$)	(NT$)	(NT$)
0 -10,000	4,500	------	-------	7,500	*
10,000 -20,000	10,800	------	11,900	11,800	6,500
20,000 -30,000	16,400	17,500	17,200	16,700	13,200
30,000 -40,000	23,000	26,800	23,000	20,300	*
40,000 -50,000	28,000	27,500	27,800	*	------
50,000 -60,000	34,200	35,800	33,400	------	------
60,000 -70,000	46,300	44,200	*	------	------
70,000 -80,000	50,800	47,500	*	------	------
80,000 -90,000	52,500	52,500	------	------	------

--- Dashes show no data available.

* Only one farm was in this group.

a/ Gross farm receipts were consistently less than farm expenses because a large share of the items included in farm expenses were used in producing the farm privileges, which are not included in gross farm receipts.

Figure 5
Linear Regression Lines of Total Farm Expenses per *Chia*
to Gross Farm Receipts per *Chia*,
in Four Economic Land Classes in the Rice Region.
Four Townships in the Taipei Area, Taiwan, China, 1961



The total farm expenses includes cash expense, depreciation, estimated value of family and operator's labor expense and interest charge on capital.

III. Relation of fertilizer expense per chia to crop income per chia

Since agricultural production is a biological process, the response of output to the change of input follows a common pattern, which is expressed by the laws of increasing and diminishing returns. On the other hand, the cost of input and the price of output fluctuate incessantly. Thus the rate of application of input in order to bring about the appropriate amount of output for a maximum net return varies. Therefore, the procedure adopted for determining the appropriate amount of input to be applied in order to obtain the maximum economic returns should be based on the known physical relationships between input and output, and the prospective prices of outputs and the costs of inputs. In this study, the input-output analysis is limited to the relationship between the value of fertilizer inputs and crop output values among economic land classes.

Table 46 shows the relation of fertilizer expense per chia, including cash purchased fertilizer and self-supplied fertilizer, to crop income per chia. Land Class 1 shows a higher rate of increase in value than Land Classes 2, 3 and 4. Land Class 4 shows the lowest crop income per chia.

In a system of rectangular coordinates, the horizontal scale represents the fertilizer expense per chia applied to the farm, and the vertical scale refers to the crop income per chia. The relationship between input and output among land classes is shown in Figure 6. Land Class 1 lies on the top, followed by Land Class 2, with Land Class 4 in the bottom position. The tendency shows that the rate of output differed at different intensity levels. When the first few units of input were added, output increased rapidly. Afterwards, the law of diminishing returns operated, and thenceforth output increased at a diminishing rate for each subsequent unit of input applied. This tendency persisted for quite a while until at last output actually decreased with the further application of fertilizer, in Land Classes 1 and 2. Most farmers stopped before additional units of expense were applied at a loss in relation to the added income.

When second order functions were applied to fit the data, the estimated maximum crop incomes per chia for Land Classes 1, 2, 3 and 4 were about 33,400, 26,700, 22,600 and 20,900 N.T. dollars per chia respectively, corresponding to fertilizer expenses of about 6,100, 5,600, 5,000 and 4,000 N.T. dollars per chia in the respective land classes (Figure 7). The functions are:

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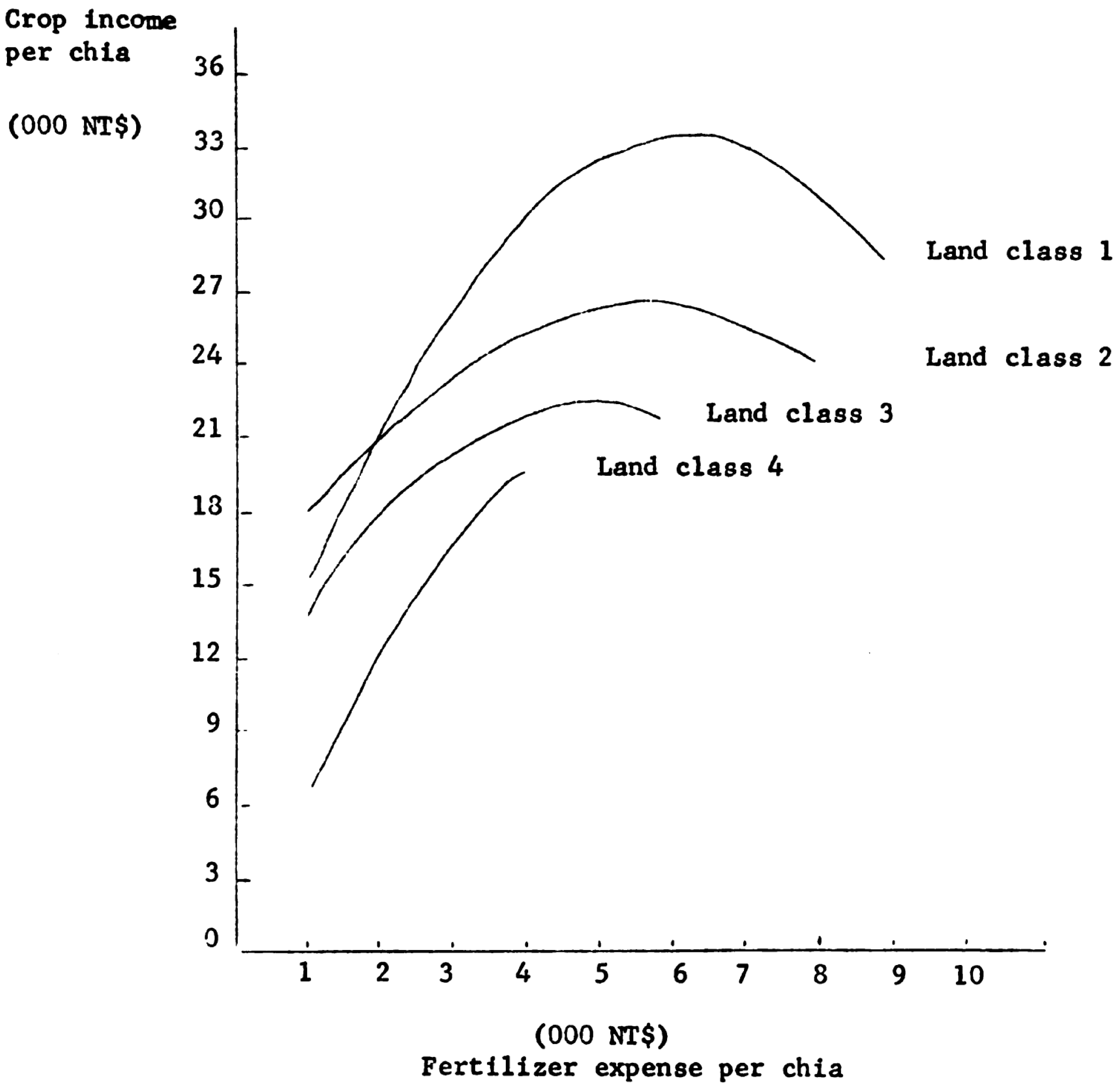
Figure 7
Parabolic Functions Expressing the Relationship of Fertilizer Expense per Chia to Crop Income per Chia, in Four Economic Land Classes in the Rice Region, Four Townships in the Taipei Area, Taiwan China, 1961



Economic land class 1 $y_1 = 7.4 + 8.6x_1 - 0.7x_1^2$

Economic land class 2 $y_2 = 13.9 + 4.5x_2 - 0.4x_2^2$

Economic land class 3 $y_3 = 7.6 + 6.0x_3 - 0.6x_3^2$

Economic land class 4 $y_4 = -2.1 + 9.1x_4 - 0.9x_4^2$

Where x_1, x_2, x_3 and x_4 represent fertilizer expense per chia and y_1, y_2, y_3 and y_4 represent crop income per chia for Land Classes 1, 2, 3 and 4 respectively. A unit is 1,000 N.T. dollars.

The farmers used chemical fertilizers at about the quantity supplied by the Taiwan Provincial Food Bureau. According to the Taiwan Food Statistical Book, the average quantities of Nitrogen, Phosphorus, and Potassium (N, P and K) contained in chemical fertilizer which were actually allocated for each hectare of land (approximately 1 chia) for the entire island in 1961 were as follows:

	For the 1st paddy rice crop (kg per hectare)	For the 2nd paddy rice crop (kg per hectare)
N	114.71	92.37
P	43.96	29.96
K	30.50	28.32
Total	739.67	628.54

Some farmers had more chemical fertilizers than they felt it was profitable to use in their paddy fields. They, therefore, sold their surplus to farmers who wanted more chemical fertilizers for their crops. The farmers near Taipei planted winter crops on about 13 percent of the paddy fields. They used mostly manure and night soil which came from their own households or was purchased from those who brought it from Taipei City. Those who raised vegetables used a lot of this organic fertilizer.

The use of chemical fertilizers in the Rice Region was rather stable. The variation in the amount of fertilizer expense was influenced mostly by the use of the organic fertilizers on winter crops.

Table 47 shows the percent distribution of fertilizer expense by class intervals. In Land Class 1, 73 percent of the farmers spent between NT$ 3,000 and 6,000 per chia for fertilizer, and only 6 percent spent less. In Land Class 2, 58 percent spent

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between NT$ 3,000 and 6,000; 41 percent spent less. In Land Class 3, 34 percent spent between NT$ 3,000 and 5,000 per chia for fertilizer and 58 percent spent less. Finally, in Land Class IV, only 18 percent spent between NT$ 3,000 and 5,000 per chia for fertilizer and 82 percent spent less. These figures probably reflect quite accurately the relative capacity of land in the four classes to yield a return for fertilizer expenditures, as the farmers have experienced it.

Table 46. Relation of Fertilizer Expense Per Chia to Crop Income per chia, by Economic Land Classes, Rice Region, Four Townships near Taipei, 1961.

Fertilizer expense per chia a/	Total crop income per chia b/				
	Total	Class 1	Class 2	Class 3	Class 4
(NT$)	(NT$)	(NT$)	(NT$)	(NT$)	(NT$)
1,000	11,000	17,500*	16,500	12,800	5,800
2,000	19,800	20,000*	23,500	17,800	11,200*
3,000	24,800	28,100	24,500	21,600	17,500*
4,000	25,000	28,200	25,500	20,500	19,200*
5,000	26,400	29,000	25,600	22,000	------ c/
6,000	30,200	34,300	25,800	22,500*	------
7,000	32,200	38,500	25,500	------	------
8,000	32,400	35,800*	25,000	------	------
9,000	24,200*	22,500*	------	------	------

* Average represents less than 5 farms.

a/ Mid-points of class intervals are listed; for example, the average crop income in response to 9,000 N.T. dollars of fertilizer expense is calculated from the group in which every sample farm used a fertilizer expense ranging from 8,000 to 10,000 N.T. dollars.

b/ All of the total crop income figures have three significant figures.

c/ Dashes show no data available.

Table 47. Percent Distribution of Fertilizer Expense, by Economic Land Classes, Rice Region, Four Townships near Taipei, 1961.

Amount of fertilizer expense per chia	Percent of Farms			
	Land class 1	Land class 2	Land class 3	Land class 4
0 - 1,000	0	6	16	57
1,000 - 2,000	3	6	24	19
2,000 - 3,000	3	19	18	6
3,000 - 4,000	21	25	13	6
4,000 - 5,000	18	20	21	12
5,000 - 6,000	34	13	3	0
6,000 - 7,000	9	6	5	0
7,000 - 8,000	6	5	0	0
8,000 - 9,000	3	0	0	0
9,000 -10,000	3	0	0	0
Total	100	100	100	100

Chapter VI

Summary

Farm management is the study of the factors which influence the success of farmers in earning an income and accumulating capital on their farms. In this economic land classification study farm management data also verified the specific differences in land use between two agricultural regions, and among and within four economic land classes. The data support the basic theories and hypotheses of land-people relationships as listed in Chapter I. The results can be summarized as follows:

This study area, consisting of Hsin-chaung, Shu-lin, Ying-ko and Shan-hsia Townships, was divided into two agricultural regions and mapped according to broad differences in land use patterns. These are usually caused by differences in climate and distance from market. In the Taipei area, the differences in agricultural regions were cuased mostly by climatic differences including irrigation. Elevation and topography were also important causal factors, associated with climate. The two regions were the Rice Region, which has a high rainfall and a good irrigation system to produce paddy rice, and the Upland Region, located usually at the higher elevations where the irrigation system is poor or non-existent.

The Rice Region in the Taipei Area is more densely populated and intensively used than the Upland Region. When the incomes of farms within the same land class are compared between the two regions the difference is not significant. This supports the hypothesis that agricultural regions do not necessarily differ in the income produced per family or per person, but do vary in how many persons are supported per unit of area.

Land also differs within regions in the intensity of use to which it is adapted. Varying intensity within regions is caused by differences in the physical characteristics of land, such as changes in soil and topography. These characteristics of land were used as criteria to determine economic land classes. The land classes were characterized by differences in income per person.

In this study five economic classes were recognized and mapped. Land Classes 1, 2, 3 and 4 were found in the Rice Region and Land Classes 3, 4 and 5 in the Upland Region. Only Land Classes 1 to 4 were carefully studied to give a basis for drawing general conclusions. Differences in the intensity of use per chia and income per family were found to vary

significantly among economic land classes, being highest in Land Class 1 and lowest in Land Class 4. In the Rice Region, the yields of the first rice crop in Land Class 1, 2, 3, and 4 were about 3,000, 2,850, 2,700 and 2,350 kilograms per chia, respectively.

Within each economic land class, a further difference in income was related to size of farm business. The variations in income per farm seemed to be greater among sizes of farm (when size was measured as land area per farm) than among economic land classes. When size of business was measured as volume of sales or days of work, it was interrelated with economic land class. In this study, families who operated large farms on the best land earned the highest income. If a farm family operated less than about 0.5 chia of land the management and labor return was very low, even on better-than-average land. From the viewpoint of labor and capital, and use of management capacity of the operator, it was apparent that increasing the size of the farm by adding more land would probably be one of the most profitable ways available to increase income per farm family, for farmers with the necessary management capacity, especially on the best land.

In respect to the relationships of capital to income the data showed that total capital was more closely related to labor and capital earnings per man, than to other measures of income. Generally in this study, non-residual measures of income on a per family or per person basis were more consistent in their relationships to capital than residual measures of income. Gross income and cash expense also tended to be proportionate to total farm capital, about 10 percent and 25 percent, respectively, in this study. Cash expenses were also proportionate to gross earnings. Contributors of fertilizer, insecticides, hired labor, machinery repairs and the like received about 40 percent of gross earnings on each of the land classes in this study area. The data lend support to the original hypothesis that factors of production share in proportion to the volume of production, and not on a basis that some factors of production have prior claims, and others residual claims.

The relation between fertilizer expense per chia and crop income per chia generally followed the law of diminishing returns. Among economic land classes, Land Class 1 showed a high productivity and high capacity for using fertilizer, and Land Class 4 showed a low productivity and capacity. The production function curves were at different levels.

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Appendix I

Sampling Procedure

I. Situation

In order to make farm visits for a farm management survey in March of 1962 the sample had to be designed based upon a preliminary land class map showing two agricultural regions and three economic land classes. It seemed best to conduct a farm management survey at this time because (1) it was the beginning of the Chinese lunar New Year and farmers were not busy on their farms, and (2) graduate students of the Institute of Rural Socio-Economics at National Taiwan University were on vacation and were therefore able to serve as enumerators,

II. Designing the Farm Sample

Budget and time limitations made it necessary to limit the number of interviews to about 250. This was decided by estimating the interviewing cost per household and the coefficient of variation of the distribution of farms by size, using the results of the 1956 agricultural sample census. Dr. Charles F. Sarle, a Visiting Professor of the Agricultural Development Council, (then the Council on Economic and Cultural Affairs) from the University of Florida, acted as consultant in deciding sampling procedures. It was decided to allocate to each of the land classes of the Rice Region approximately 50 cases, and 100 to the Upland Region. Within each agricultural region and economic land class the sample population was stratified by size. The size classes were determined after reviewing previous farm management studies and township data by agricultural regions. Samples were designed to distribute the cases equally among the various size groups. The size classes of farms by agricultural region were:

	Rice Region	Upland Region
very large	1.35 *chia* and larger	-------------
large	0.95 to 1.34 *chia*	2.50 *chia* and larger
medium	0.55 to 0.95 *chia*	1.25 to 2.49 *chia*
small	0.54 *chia* and smaller	1.24 *chia* and smaller

III. Procedure

1. The preliminary land class map showing two agricultural regions and three economic land classes was brought to the township offices for the purpose of asking the local leaders the approximate location of sub-villages (lin) by regions and economic land classes so that each lin and the farms within it could be classified. The distribution of the li and lin in various agricultural regions and economic land classes was as follows:

Name of township	Number of li	Number of lin
Hsing-chuang	14	211
Shu-lin	17	223
Ying-ko	15	183
Shan-hsia	24	392
Total	70	1,009

2. Those villages (li) or sub-villages (lin) were discarded which were (1) obviously non-agricultural (no farm households) or (2) covered by national forest. The distribution of li and lin available for sampling was as follows:

Name of Township		Total	Rice region						Upland region	
			Class 1		Class 2		Class 3 & poorer			
			Number	%	Number	%	Number	%	Number	%
Hsin-chuang	Li:		11		7		1		1	
	Lin:	178	127		41		8		4	
	Households:	1,541	859	88	586	24	38	4	58	5
Shu-lin	Li:		5		14		9		7	
	Lin:	181	24		87		42		28	
	Households:	1,792	113	12	1,006	40	421	39	252	22
Ying-ko	Li:		0		6		4		6	
	Lin:	120	0		57		15	16	48	
	Households:	1,052	0	0	486	20	172	16	400	35
Shan-hsia	Li:		0		12		17		16	
	Lin:	212	0		70		78		64	
	Households:	1,276	0	0	389	16	445	41	442	38
Total	Li:		16		39		31		30	
	Lin:	691	151		255		143		142	
	Households:	5,667	972	100	2,467	100	1,076	100	1,152	100

[illegible]

[illegible]

[illegible]

3. Sixteen percent of the lin were selected randomly by using the random table.

4. Farm samples were taken proportionately to the distribution of farm households in the respective land classes of the different townships. Farms in each land class were grouped by size based on data from the 1960 census. The random table was also used for the selection of individual farms. The sample taken was doubled in each stratum to provide an alternate case if the original could not be interviewed.

IV. Results

The results of the selection of the lin and the allocation of samples in each of the agricultural regions and economic land classes by townships were as follows:

Township	Total		Rice Region						Upland Region	
			Class 1		Class 2		Class 3 a/			
	Lin	Farms	Lin	Farms	Lin	Farms	Lin	Farms	Lin	Farms
Hsin-chaung	29	63	20	44	7	12	1	2	1	5
Shu-lin	30	69	4	6	14	20	7	20	5	22
Ying-ko	20	54	0	0	9	10	3	8	8	35
Shan-hsia	33	64	0	0	11	8	12	20	10	38
Total		250	50	50		50		50		100

a/ Class 3 in this table includes land class 3 and poorer.

V. Changes in the actual sample from the planned sample.

The distribution of the sample varied a little from the original plan. The reasons for change in the sample were as follows:

Reason	Number of cases
Refusal	6
Absence from home	5
Emigrated out of the area	4
Recent death of the operator	2
Total	17

Therefore, the farm samples actually taken were as follows:

Distribution of Sample Farms by Agricultural Regions and Economic Land Classes

Township	Total	Rice Region			
		Total	Class 1	Class 2	Class 3 and poorer
Hsing-chuang	61	57	42	13	2
Shu-lin	65	46	8	18	20
Ying-ko	53	18	0	10	8
Shan-hsia	71	29	0	9	20
Total	250	150	50	50	50

Distribution of Sample Farms by Farm Size

Size of farm (chia):	Rice region				Upland region		
	0-0.54	0.55-0.94	0.95-1.34	1.35-& more	0-1.24	1.25-2.49	2.50 & more
Township							
Hsin-chuang	9	19	16	13	2	1	1
Shu-lin	13	10	13	10	7	8	4
Ying-ko	3	9	1	5	18	10	7
Shan-hsia	4	4	6	15	18	12	12

VI. Effect of changes in the land class map on the sample.

Some changes were made in the final economic land class map after the sample was drawn. Four land classes were shown in the Rice Region and two classes in the Upland Region compared with three and none, respectively, in the original map used for choosing a sample. The land located in Shi-shen Li of Hsing-chuang, which was originally classified as Land Class 1, was changed to Land Class 2, based on local opinion, land grades, field observations, and the farm management survey. All of the sample farms were put on the map showing their location, as indicated by the enumerators, in order to check the original land class ratings. The final distribution of the sample was as follows:

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Distribution of Sample Farms

Agricultural region	Land class	1.35 chia and larger	0.95 to 1.35 chia	0.55 to 0.95 chia	0.54 chia and smaller	Total
Rice	1	7	10	9	7	33
	2	30	18	25	12	85
	3	19	9	7	3	38
	4	8	2	4	2	16
		2.50 chia & larger	1.25 to 2.49 chia	1.24 chia & smaller		
Upland	3	5	5	9		19
	4	18	20	21		51

Appendix II

Conversion Factors

	To convert from	Multiply by	To obtain
I. Rice weight			
	Ponlai paddy rice	0.686	Ponlai polished rice
	Ponlai paddy rice	0.762	Brown rice
	Ponlai brown rice (domestic)	0.93	Polished rice
II Weight			
	Catty (Taiwan)	1.31575	Pounds
	Pound	0.76002	Catty (Taiwan)
	Catty (Taiwan)	0.59682	Kilogram
	Kilogram	1.67556	Catties (Taiwan)
III. Area			
	Chia	0.96992	Hectare
	Hectare	1.03102	Chia
	Chia	2.39680	Acres
	Acre	0.41720	Chia
	Square kilometer	100.	Hectares
	Square mile	2.59	Square kilometers
	Chia	2,934.	Ping
	Hectare	3,000.	Ping
	Ping	3.97	Square yards
IV. Length			
	Kilometer	0.62	Mile
	Mile	1.61	Kilometers
	Meter	3.28	Feet
V. Value			
	U.S. dollars	40.00	N.T. dollars